Everglades Agricultural Area Storage Reservoirs. DRAFT (9/11/98)

Description of Simulations

The scenario simulations for reservoirs in the EAA were performed to investigate the sensitivity of the regional system to changes in the configuration and size of the EAA reservoir component as defined for Alternative D13R of the Restudy.

Assumptions

It is important to keep in mind that this sensitivity analysis is performed with the assumption that all the components proposed in ALTD13R are in place and fully operational as modeled. Other components of the system in ALTD13R, particularly LOK ASR, increase the system's total storage capacity such that impacts of changes in the EAA reservoirs on key performance indicators are minimized. Due to the uncertainty of some of the components proposed in ALTD13R, decisions or interpretations with regard to the importance or relevance of all or any portion of the EAA reservoir component based on this analysis must be made with caution. For modeling purposes, the simulated impacts of changes in EAA reservoir(s) are highly dependent on the assumed state (condition governed by existing and/or proposed operating policies) of the rest of the system in the simulation. The same is true for all other components analyzed.

All the runs related to the EAA reservoirs were derived from the Alternative D13R simulation input data by modifying the size or by completely removing one or more reservoir compartments in the EAA (Component G5). Table 1 summarizes the conveyance capacity factors for the portion of the canals north of the reservoir(s), and the configurations for the reservoirs in each simulation. Compartment 1 supplies water for EAA irrigation requirements only. Compartment 2A provides for environmental demands and when no environmental demands are imposed, EAA irrigation demands not met by Compartment 1. Compartment 2B provides for only environmental demands. Compartments 2A and 2B are also known as the surge tanks. The outflow from the surge tanks for environmental demands is routed through STA 3 and 4 before entering WCA-3A. A total of 4 scenarios were simulated and compared to ALTD13R.

Table 1. Scenario Definitions for the EAA Reservoirs Sensitivity Analysis

Run Legend	Canal Conveyance Factor [1]		Compartment Surface Areas (acres)		
	Miami Canal	**NNR Canal**	**1**	**2A**	**2B**
ALTD13R	3.0	3.0	20000	20000	20000
SGT4020	3.0	3.0	20000	40000	20000
SGT1x20	3.0	3.0	20000	20000	0
EAARS	1.0	2.0	20000	0	0
NEAARS	1.0	2.0	0	0	0

1 = Canal conveyance factor applies only for the portion of the canals north of the reservoir(s) that convey excess Lake Okeechobee water to appropriate reservoir(s).

For the scenarios where Compartments 2A and 2B do not exist, then the canal conveyance factor corresponds to the flow-through capacity for discharges from Lake Okeechobee to the Everglades Protection Area (EPA). The flow-through capacity is the same for all the simulations.

Two of the 4 scenarios (SGT4020, SGT1x20) involve changing the size of the surge tanks only as indicated in Table 1; no major functional component is removed. It is important to note that Compartment 2A, which is the surge tank used first for excess LOK water, increases 20000 acres in SGT4020 simulation while the Compartment 2B, which is used less often, is removed in the SGT1x20 simulation. The EAARS simulation completely removes the surge tanks. The NEAARS simulation takes a step further by removing Compartment 1 as well, such that no EAA reservoirs remain.

All reservoirs were kept to maximum depth of 6 feet. In each case, the addition or removal of 20000 acres of reservoir surface area generates the conversion of modeling cells to wetland or sugar cane land use types respectively. When a given reservoir is removed, associated inflow and outflow control structures and internal canals are also removed.

Summary of Results

In this analysis, the scenario simulations are compared with ALTD13R. Significant findings unique to each scenario will be presented first, then findings common to some or all scenarios will be presented.

1. Increasing the size of Compartment 2A (north surge tank) from 20000 acres in ALTD13R to 40000 acres (SGT4020) results in the following:

   - Increase (approximately 40 kac-ft/year) in the diversion of Lake Okeechobee excess water to the surge tanks (Figure 9). The additional storage in the surge tanks translates to 28 kac-ft/year increase in outflow from the surge tanks to meet Everglades needs (Table 3).
   - Slight decrease (10 kac-ft/year) in environmental water supply releases from Lake Okeechobee (Table 3 and Figure 6).
   - Decrease in EAA runoff south from 610 kac-ft/year to 579 kac-ft/year (Table 3) and a decrease in LOK water supply volumes in meeting EAA demands from 174 kac-ft/year to 160 kac-ft/year due to the decrease in the EAA production area.
   - Decrease in injection volumes into LOK ASR (264 kac-ft/year to 249 kac-ft/year) as a consequence of the increase in diversion of excess LOK water to surge tanks (Table 3 and Figure 9), which decreased stages in LOK (<0.05 ft) enough to marginally decrease the opportunity for ASR injection.

2. Removing Compartment 2B (south surge tank) from ALTD13R results in the following:

   - Decrease in the diversion of excess Lake Okeechobee water to EAA storage from 278 kac-ft/year to 258 kac-ft/year (Figure 9). The 20 kac-ft/year decrease in inflow of LOK water as a result of removing Compartment 2B is considerably less than the 39 kac-ft/year increase in inflow of LOK water into EAA storage as a result of increasing the size of Compartment 2A by the same acreage (20000 acres). This is because Compartment 2A is first priority in receiving excess LOK water and is utilized more often.
   - Slight increase (7 kac-ft/year) in environmental water supply releases from Lake Okeechobeee (Table 3).
   - Increase in EAA runoff south from 610 kac-ft/year to 641 kac-ft/year (Table 3) and in LOK deliveries to meet EAA demands from 174 kac-ft/year to 182 kac-ft/year, due to the 20000 acre increase in the EAA production.

- No change in injection of LOK water into ASR compared to ALTD13R. The 20 kac-ft/year decrease in the diversion into EAA storage of excess LOK water is largely offset by the increase in LOK releases for environmental water supply and meeting EAA demands, resulting in an insufficient change in LOK storage (or stage) to increase the duration of injection of LOK water into ASR wells.

Thus far the analyses have only involved changing the total area of the surge tanks without removing major functional components that would significantly affect the storage capacity of the EAA reservoir system. No significant system-wide performance gains or losses were obtained from increasing Compartment 2A size from 20000 to 40000 acres or from removing Compartment 2B. Varying the size of the surge tanks produced no change in percent of demand not met in EAA (Figures 11 and 12). In general, a decrease in the storage capacity of the surge tanks generated a slight increase in flows to WCA-3A and, therefore, the ENP (Tables 3 and 4), but does not affect the monthly distribution (timing) of overland flow in northern WCA-3A (Figure 16 and 17) or in the ENP (Figures 18 and 19).

3. The next scenario run (EAARS) removes Compartments 2A and 2B. The total storage capacity of the EAA reservoir is significantly reduced. In addition, the ability to remove excess LOK water is also significantly reduced. The significant findings for the EAARS simulation are the following:

   - The EAARS simulation produces the highest stages in Lake Okeechobee of any of the scenarios simulated (Figure 4). The average increase in LOK stage is about 0.25 feet with maximum increase of 0.5 feet during drought years when compared to ALTD13R. The main reasons for this are: 1) elimination of releases of excess LOK water to the surge tank(s), which averaged over 250 kac-ft/year (Figure 9), in conjunction with 2) Compartment 1 providing approximately 150 kac-ft/year in meeting EAA demands. The diversion of excess LOK water to the surge tanks in ALTD13R occurred before ASR injection. As a consequence of reducing the capacity of the system to remove excess water from LOK, the LOK stages rise, or are forecasted to rise, above the ASR injection line more often. This increases the volume of injection into ASR wells from 264 kac-ft/year in ALTD13R to 333 kac-ft/year with surge tanks removed, as seen in Figure 9 and Table 3. Since most of the water injected into the ASR is assumed to be retrievable, more storage is available during dry times for meeting demands, keeping stages in LOK higher. For example, Figure 10 shows a comparison of annual injections and recoveries for the Lake Okeechobee ASR component, for the SGT1x20 and the EAARS simulations. The EAARS simulation not only stores more water in ASR, but also provides more water from ASR to Lake Okeechobee during the years 1977, 1981, and 1990, for which the ASR in SGT1x20, and most likely the other simulations with the surge tanks, could not supply any water. As expected, the EAARS simulation exhibits the largest mean LOK ASR recovery volume for the drought years (Table 3), since the opportunity for ASR injection is the greatest.
   - The higher Lake Okeechobee stages produced in the EAARS simulation reflected into higher stages for the North Storage, the C-44, and the Taylor Creek-Nubbin Slough reservoirs and slightly higher stages in the C-43 reservoir (Figures 20 to 23). The higher stages for North storage, the C-44, and the C-43 reservoirs are largely a result of the increased opportunity for excess Lake Okeechobee water to be routed to these reservoirs. In addition, backpumping volumes from the C-43 reservoir to Lake Okeechobee, which occurs only when LOK stage is below the pulse zone, decreases

slightly (153 kac-ft/year in ALTD13R to 148 kac-ft/year in the EAARS simulation) due to the increased stages in Lake Okeechobee. This decrease in C-43 reservoir backpumping contributes to the increase in stages in C-43 reservoir relative to ALTD13R. Similarly, the increase in the stages in the Taylor Creek-Nubbin slough reservoir is due to a decrease in outflow from the reservoir to Lake Okeechobee (93 kac-ft/year to 81 kac-ft/year), because LOK stages in the EAARS simulation are below the maximum threshold for outflow from the reservoir less often.

- The number of undesirable Lake Okeechobee stage events having stages below 11.0 feet for longer than 100 days increased from 1 to 2 (Figure 8). This is a misleading statistic, however. The reason for this increase is that the EAARS simulation breaks another event lasting from May 1981 to June 1982 in the other simulations into two events below 11.0 feet.
- For water supply to Lake Okeechobee service areas, this scenario performs best. The percent of demand not met for the EAA decreased from 5% for simulations with surge tanks, including ALTD13R, to 3% in EAARS simulation for the entire simulation period. During the drought years, the percentage decreases from 14% for simulations with surge tanks to 9% for EAARS simulation (Figures 11 and 12).
- The total number of cutback months triggered by the Lake and by the dry season criteria decreased by 50% for all service areas (Figure 13). In response to the decrease in regionally triggered cutbacks, the number of locally triggered cutback months increased by one in service area 2.
- The dependence on Lake Okeechobee for environmental water supply to the Everglades increased significantly. The volume of LOK environmental water supply releases increased from 149 kac-ft/year in ALTD13R to 296 kac-ft/year in EAARS simulation (Table 3). In addition, LOK water supply volumes to meet EAA demands increased from 174 kac-ft/year to 204 kac-ft/year (Table 3) due to the elimination of Compartment 2A which provided 5 kac-ft/year for meeting EAA demands, and the increase in EAA production area due to the removal of the surge tanks. The average total water supply delivery from Lake Okeechobee to EAA and Everglades increased from 323 kac-ft/year in ALTD13R to 500 kac-ft/year for the simulation period, an increase of 177 kac-ft/year (Table 3). However, the diversion of excess water to the surge tanks from LOK (Figure 9) averaged 278 kac-ft/year in ALTD13R, which no longer occurs in EAARS simulation. The decrease in outflows from LOK to EPA is evident in Figure 5. The Miami canal (S-354) was used first in delivering excess water to the EAA surge tanks. As a result, nearly 90% of the excess water was delivered to the surge tanks via the Miami Canal through S-354. Thus, S-354 flows were affected much more from the removal of the surge tanks.
- In going from ALTD13R to the EAARS simulation, Lake Okeechobee flood control releases to the St. Lucie estuary, to the Caloosahatchee estuary and to the WCAs increase by 4 (21%), 5 (32%) and 13 kac-ft/year (13%), respectively (Figure 9). The elimination of Lake Okeechobee flood control releases to the EAA surge tanks (278 kac-ft/year) is compensated mainly by large increases in environmental releases to the Glades (147 kac-ft/year), in LOK ASR injection (69 kac-ft/year), in supplemental irrigation to the EAA (20 kac-ft/yer), in flood control releases (21 kac-ft/year) and in Lake evapotranspiration (12 kac-ft/year). The increase in evapotranspiration is a consequence of the increase in Lake stages.
- Total volumes of upstream inflow into the EPA are the lowest in the EAARS simulation. The total flow is 1091 kac-ft/year in EAARS compared to 1135 kac-ft/year in ALTD13R (Table 3 and Figure 6). The increase in EAA runoff south and in LOK environmental water supply volumes totaling 217 kac-ft/year does not fully

compensate for the elimination of environmental water supply releases from the EAA reservoirs provided in ALTD13R (See Table 3).

- The decrease in total structural inflow into the EPA and overland flow volumes across the EPA (Tables 3 and 4 or Figures 17-19) translates to slightly lower stages for several of the indicator regions in the EPA (Figures 1 and 2 and Table 2). The lowering of weekly stages never exceeds 0.1 feet on average as indicated in Figures 1 and 2.

4. The last scenario, called NEAARS, completely removes all compartments of the EAA reservoir. The EAA production area is similar to the future without project condition. The consequences of this are the following:

- Significant increases in the EAA runoff south. The EAA runoff south increases from 610 kac-ft/year in ALTD13R to 870 kac-ft/year in the NEAARS simulation (Table 3). This increase is not only the result of the transformation of 60000 acres of reservoir back to agricultural land, but also the removal of the diversion of EAA runoff to Compartment 1, which was removed in the NEAARS simulation.
- Significant increase in the dependence on LOK for environmental water supply deliveries. The volume of the deliveries increased from 149 kac-ft/year in ALTD13R to 251 kac-ft/year in the NEAARS simulation. The increase in environmental releases in the NEAARS simulation is not as great as in the EAARS simulation mainly because the EAA runoff south is so much greater in the NEAARS simulation (200 kac-ft/year greater) due to the removal of Compartment 1, that the demand for environmental water supply deliveries decrease slightly (See Table 3).
- The removal of Compartment 1 increases the percentage of mean annual demand not met in the EAA from 5% in ALTD13R to 8% (Figure 11). During the drought years, the percentage increased from 14% to 19% (Figure 12). The corresponding figures for the 95 base case are 12% for the simulation period and 18% during the drought years. In the NEAARS simulation, Lake Okeechobee is the sole source of water supply to the EAA. The LOK deliveries in meeting EAA demands more than doubles from 174 kac-ft/year in ALTD13R to 357 kac-ft/year in NEAARS simulation. As a result, LOK stages significantly decrease (approx. 0.5 feet) during dry periods (Figure 4), thus increasing the demand not met in the Lake Okeechobee service area.
- The total inflow to the EPA is the highest in this scenario (Table 3 and Figure 6) largely due to the increase in the EAA runoff volume south. The total inflow increases from 1135 kac-ft/year in ALTD13R to 1225 acre-ft/year, an increase of 90 kac-ft/year into WCA-3A . The stages in eastern WCA-3A increase 0.1-0.2 ft. during wetter times (Figure 1). The increase in overland flow in northern WCA-3A compared to ALTD13R occurs in the wet season which reflects the timing of the substantial increase in EAA runoff south (Figures 16 and 17). However, during the early part of the dry season (October – December), the overland flow volumes in northern WCA-3A are slightly less than the volumes in the simulations with surge tanks (ALTD13R, STG4020, and STG1x20). This is because the NEAARS simulation depends solely on Lake Okeechobee for environmental water supply, while ALTD13R, STG4020 and STG1x20 simulations have storage available in the surge tanks in addition to Lake Okeechobee during the early dry season for environmental water supply deliveries. The effects of this on stages are evident in Indicator Region 17 (south central WCA-3A), where the average duration of high water violations (>2.5 ft. depth) increases from 9 weeks to 11 weeks (due to the increased EAA runoff into WCA-3A), and the

average duration of low water violations (<-1.0 ft. depth) also increase from 2 weeks to 4 weeks (Table 2). Moreover, the number of low water violations in the northwest corner of WCA-3A (Indicator Region 22) increases by one (5 to 6) and the average duration of low water violations increases from 3 weeks in ALTD13R to 5 weeks in NEAARS simulation.

Due to the remoteness of these indicator regions, they do not receive the benefits of increased storage in areas such as the Central Lake Belt region during the dry periods. Table 2 also shows that for eastern WCA-3A (Indicator Region 19), there are 27 events, average duration of 12 weeks, of high water in ALTD13R and 30 events, average duration of 12 weeks of high water in NEAARS simulation. The increased volumes of water into WCA-3A get diverted into Central Lake Belt Storage for use during dry periods (Figure 3 and Table 3). Farther south, inflows into the ENP, with the help of Central Lake Belt storage, increase in the dry season as well.

The monthly distribution (timing) of flows into the ENP is similar to ALTD13R. The result is a 5% increase (46 kac-ft/year) in overland flow across Tamiami Trail and 10% (26 kac-ft/year) increase in S-356 A and B flows (Table 3). The increased flows into NESRS raised water levels in NESRS during dry times (Figure 2 and Table 2, Indicator Region 11).

- The total number of LECSA cutback months triggered by Lake Okeechobee and dry season criteria increased from 15 to 40 for the simulation period (Figure 13).

5. Findings common to some or all of the scenario simulations are the following:

- The following performance indicators and/or components of the system in ALTD13R show practically no sensitivity to changes in EAA reservoir: 1) Biscayne Bay flows, 2) LECSA discharges to tide, and 3) regional water supply deliveries to the LEC service areas but the total number of water restrictions for all LEC service areas increase.
- With the exception of the releases to the EAA reservoirs and to ASR, the inclusion or exclusion of EAA reservoirs does not have a major effect on the magnitude of other flood control releases from Lake Okeechobee, such as to the estuaries, to the WCAs, nor to the North Storage facility (Figure 9).
- The performance of Compartment 1 is basically independent of the existence of the other two compartments. This is because the other compartments contribute only 1-2% of the EAA demands. Compartment 1 has priority in meeting EAA demands. Changes in the EAA production area contribute to the variations (138 kac-ft/year in the SGT4020 simulation to 149 kac-ft/year in the EAARS simulation) in the mean outflow from Compartment 1. The variations in outflow are quite small, since the storage capacity of Compartment 1 does not vary. Note that the Lake Okeechobee deliveries, which back up the EAA reservoir in meeting EAA demands vary more (Table 3) as a result of the variations in EAA production area, as expected.
- The number of St. Lucie estuary low flow criteria exceedences decreases slightly in going from ALTD13R to the EAARS simulations (Figure 14). The decrease is in the number of months average flow is less than 350 cfs and is due to the higher LOK stages. The number of estuary high-flow criteria exceedences does not change for the St. Lucie estuary for any of the scenarios.
- The performance of the Caloosahatchee estuary in terms of low and high flow violations does not change for any of the simulations when compared to ALTD13R. Only in the EAARS simulation the number of months for which average flows exceeds

2800 cfs decreased from 10 to 9 (Figure 15). The change is in events lasting 1 consecutive month only.

- The number of undesirable stage events for Lake Okeechobee remains the same for all of the simulations (Figure 8), with the exception of the EAARS simulation, which is discussed earlier.
- This analysis was performed from a hydrologic perspective. The ecological effects of the hydrologic impacts of changes in the EAA reservoir system should be assessed to determine their significance.
- The EAA reservoir components are part of a complex system with many components. Although a component, such as the EAA reservoirs, is a separate entity, other components in the system proposed in ALTD13R respond to changes to a particular component because, in general, the Central and South Florida Project is highly complex and interdependent. Changes in the configuration and/or operations for the EAA reservoir system, which interacts heavily with Lake Okeechobee, the EAA, and the Everglades, have potentially far-reaching consequences. In ALTD13R, additional storage such as LOK ASR and Lake Belt storage compensate for changes in the EAA reservoir performance, lessening the impact of such changes. Thus, the impact of changes in EAA reservoir on any other component depends on the assumed state of the rest of the system.

Table 2. Inundation Duration Statistics for some Key Indicator Regions (# Events; Average Duration; % of Year)

Indicator Region (Figure 24)																				
#	Name	Depth Criterion (ft)	NSM45F			ALTD13R			SGT4020			SGT1X20			EAARS			NEAARS		
Low Water Duration																				
10	Mid SRS	< -1.0	1	1	0	2	2	0	2	2	0	2	2	0	1	1	0	0	0	0
11	NE SRS	< -1.0	1	1	0	3	2	0	3	2	0	2	2	0	2	2	0	1	2	0
12	New SRS	< -1.0	17	7	8	13	5	4	13	5	4	13	5	4	14	6	5	13	5	4
17	South Central WCA-3A	< -1.0	8	7	3	5	2	1	5	2	1	5	3	1	4	4	1	5	4	1
19	East WCA-3A	< -1.0	10	6	4	8	3	1	8	3	1	9	3	2	8	3	2	7	3	1
20	NW WCA-3A	< -1.0	6	6	2	9	5	3	9	5	3	10	5	3	10	5	3	9	5	3
21	NE WCA-3A	< -1.0	15	7	7	15	4	4	13	5	4	13	5	4	14	5	4	14	5	4
22	NW Corner WCA-3A	< -1.0	7	5	2	5	3	1	5	4	1	5	4	1	5	4	1	6	5	2
High Water Duration																				
10	Mid SRS	> 2.5	5	11	4	5	6	2	5	6	2	5	7	2	5	7	2	7	6	2
11	NE SRS	> 2.5	15	10	9	10	6	4	7	7	3	10	6	4	9	6	4	12	6	4
12	New SRS	Undefined																		
17	South Central WCA-3A	> 2.5	0	0	0	2	9	1	2	9	1	3	7	1	3	7	1	2	11	1
19	East WCA-3A	> 2.5	0	0	0	27	12	19	25	12	19	31	10	20	24	12	18	30	12	23
20	NW WCA-3A	> 2.5	0	0	0	1	1	0	0	0	0	1	1	0	2	1	0	2	1	0
21	NE WCA-3A	> 2.0	2	2	0	6	7	3	6	7	3	6	7	3	6	8	3	6	8	3
22	NW Corner WCA-3A	> 2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inundation Duration																				
10	Mid SRS	> 0.0	5	321	100	4	398	99	5	318	99	4	398	99	6	265	99	4	401	100
11	NE SRS	> 0.0	4	402	100	7	226	98	6	264	98	6	264	98	7	226	98	6	266	99
12	New SRS	> 0.0	32	42	82	27	52	87	26	54	87	29	48	87	32	43	86	28	50	87
17	South Central WCA-3A	> 0.0	24	59	87	14	110	95	15	103	96	14	110	95	15	102	95	15	102	95
19	East WCA-3A	> 0.0	25	55	86	13	115	93	13	116	93	14	107	93	16	93	93	15	100	93
20	NW WCA-3A	> 0.0	21	70	91	19	75	88	21	68	88	23	62	88	28	50	87	24	59	88
21	NE WCA-3A	> 0.0	28	49	85	31	44	84	31	44	84	30	45	84	33	40	82	26	53	85
22	NW Corner WCA-3A	> 0.0	20	73	91	19	81	95	22	69	95	23	66	94	22	69	94	18	84	94

Table 3. Mean annual flows for key components, in kac-ft/year

Row	Flow Description	Simulation				
		ALTD13R	SGT4020	SGT1X20	EAARS	NEAARS
1	Overland flow Tamiami Trail	942	934	953	908	988
2	S356 A & B	263	259	268	266	289
3	Total 1+2 (Inflow ENP)	1205	1193	1221	1174	1277
	Δ w.r.t. D13R *		-12	16	-31	72
4	Runoff South	610	579	641	680	870
5	LOK Env.	149	139	156	296	251
6	LOK Reg. to WCAs***	102	110	108	115	104
7	EAA Res. to Env.	274	302	247	0	0
8	Total 4 to 7	1135	1130	1152	1091	1225
	Δ w.r.t. D13R		-5	17	-44	90
9	LOK to EAA Demands	174	160	182	204	357
10	Total 5+9 (LOK WS)	323	299	338	500	608
	Δ w.r.t. D13R		-24	15	177	285
11	EAA Res. to EAA Demand	147	146	153	149	0
12	LOK ASR Injection	264	249	263	333	291
13	LOK ASR Recovery **	136 (348)	129 (320)	135 (351)	165 (376)	149 (323)
14	CLB Inflow	99	97	101	107	111
15	CLB Outflow	93	92	95	101	105

* Change with respect to Alt. D13R.
** Numbers in parenthesis are the mean for the drought years 1971, 1975, 1981, 1985 and 1989.
***Direct regulatory discharge to WCAs (via STAs). No diversion to surge tanks.

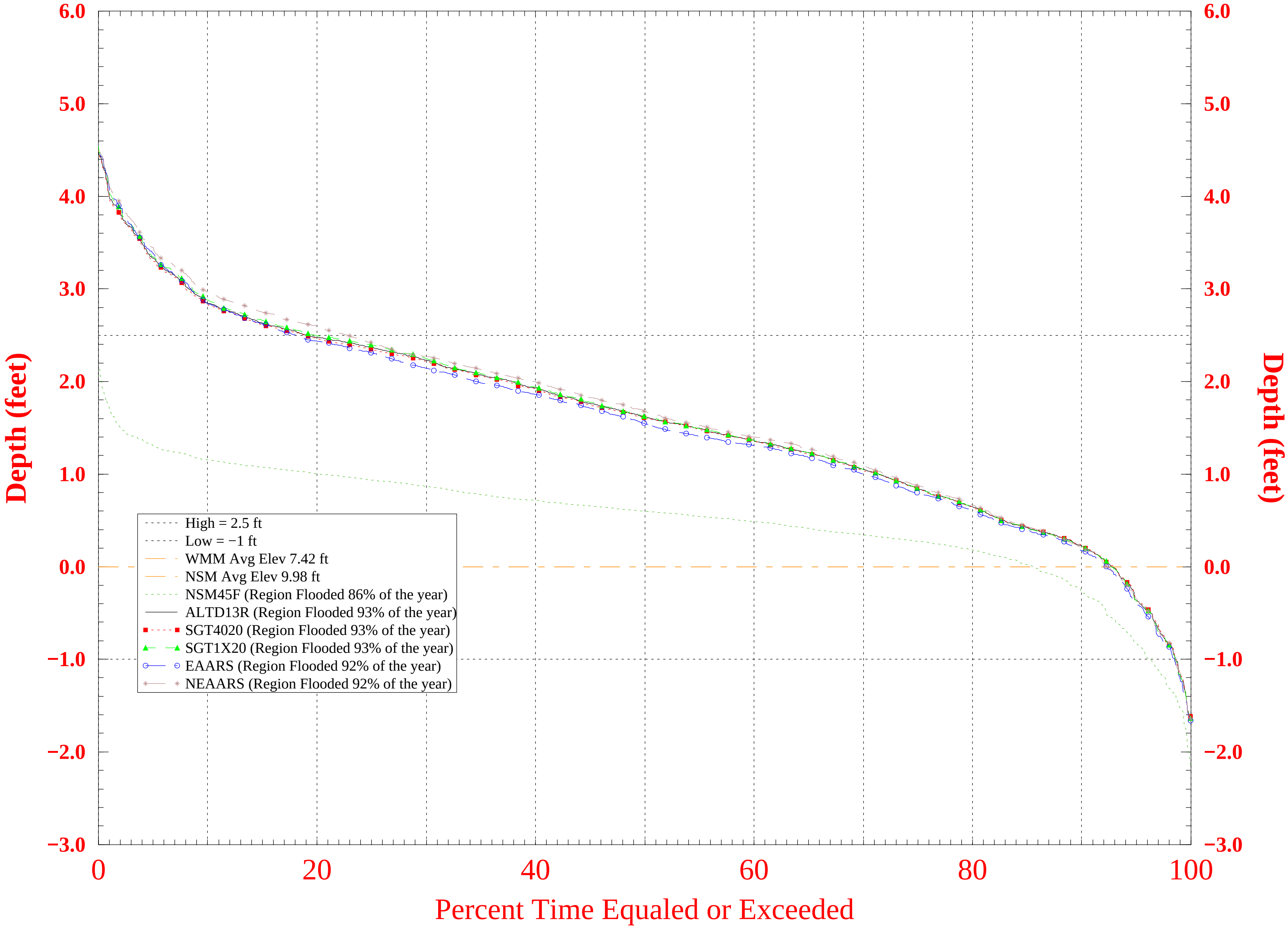
Table 4. Mean annual flows at key transects, in kac-ft/year

Transect *		Simulation				
#	**Name**	**ALTD13R**	**SGT4020**	**SGT1X20**	**EAARS**	**NEAARS**
17	Tamiami Trail W	429	424	436	416	457
18	Tamiami Trail E	508	505	512	486	523
19	ENP, W of L31N	228	224	235	228	250
	Total 17+18+19	1165	1153	1183	1130	1230
	Δ w.r.t. D13R **		-12	18	-35	65
21	SRS	1098	1088	1109	1072	1150
22	NW SRS	80	78	82	78	88
23	Southern ENP	159	159	161	159	163
	Total 21+22+23	1337	1325	1352	1309	1401
	Δ w.r.t. D13R		-12	15	-28	64
5	NW WCA-3A	222	221	225	214	236
6	NE WCA-3A	237	237	240	206	259
	Total 5+6	459	458	465	420	495
	Δ w.r.t. D13R		-1	6	-39	36
7	Alligator Alley W	363	361	367	342	386
8	Alligator Alley E	628	616	643	616	686
	Total 7+8	991	977	1010	958	1072
	Δ w.r.t. D13R		-14	19	-33	81
12	Southern WCA-3A	747	741	755	717	786

* Transects are shown in Figure 25
** Change with respect to Alt. D13R.

Figure 1. Normalized Weekly Stage Duration Curves for East WCA−3A

Indicator Region 19 (R33C25−27 R34C25−27)



Note: Normalized stage is stage referenced to Land Elevation. Thus, values above zero indicate ponding while values below zero indicate depth to the water table.

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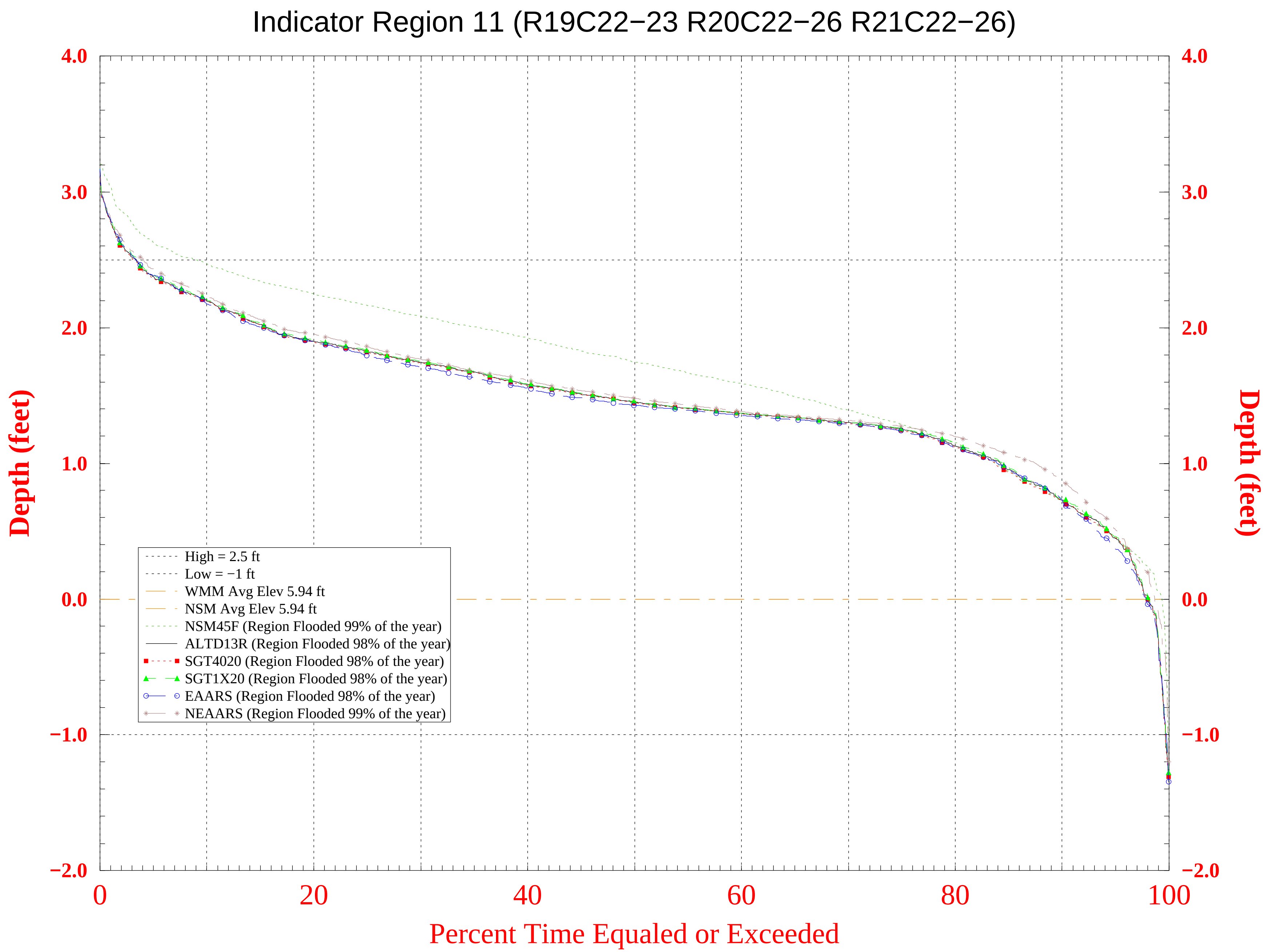
Figure 2. Normalized Weekly Stage Duration Curves for NE Shark River Slough



Note: Normalized stage is stage referenced to Land Elevation. Thus, values above zero indicate ponding while values below zero indicate depth to the water table.

Run date: Wed Aug 12 15:17:15 EDT 1998
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Figure 3. Stage Duration Curves at Central Lake Belt Reservoir

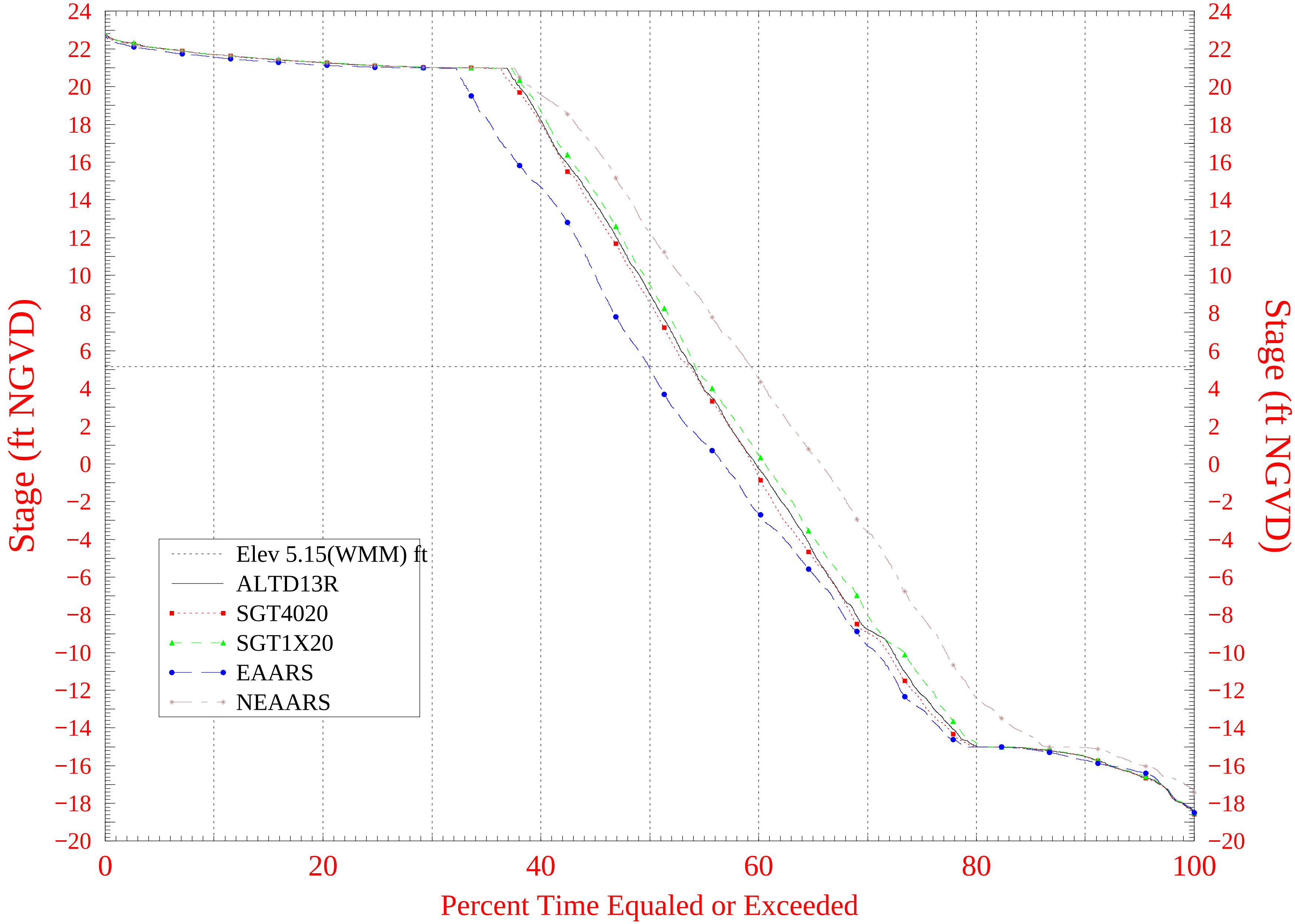

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Figure 4. Lake Okeechobee Stage Duration Curves

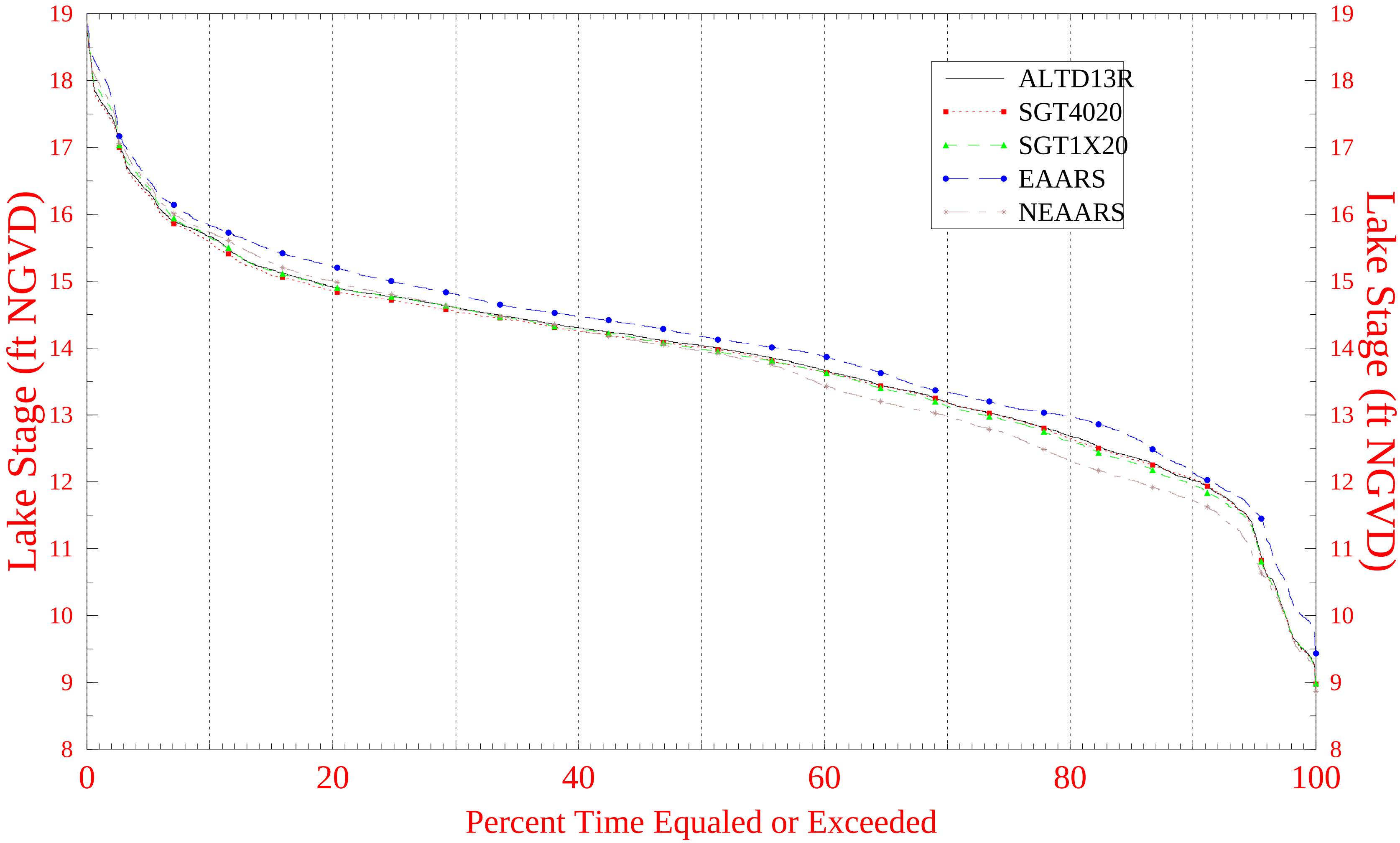

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Figure 5. EAA Reservoir Sensitivity Analysis

Annual Outflows for some Lake Okeechobee Structures

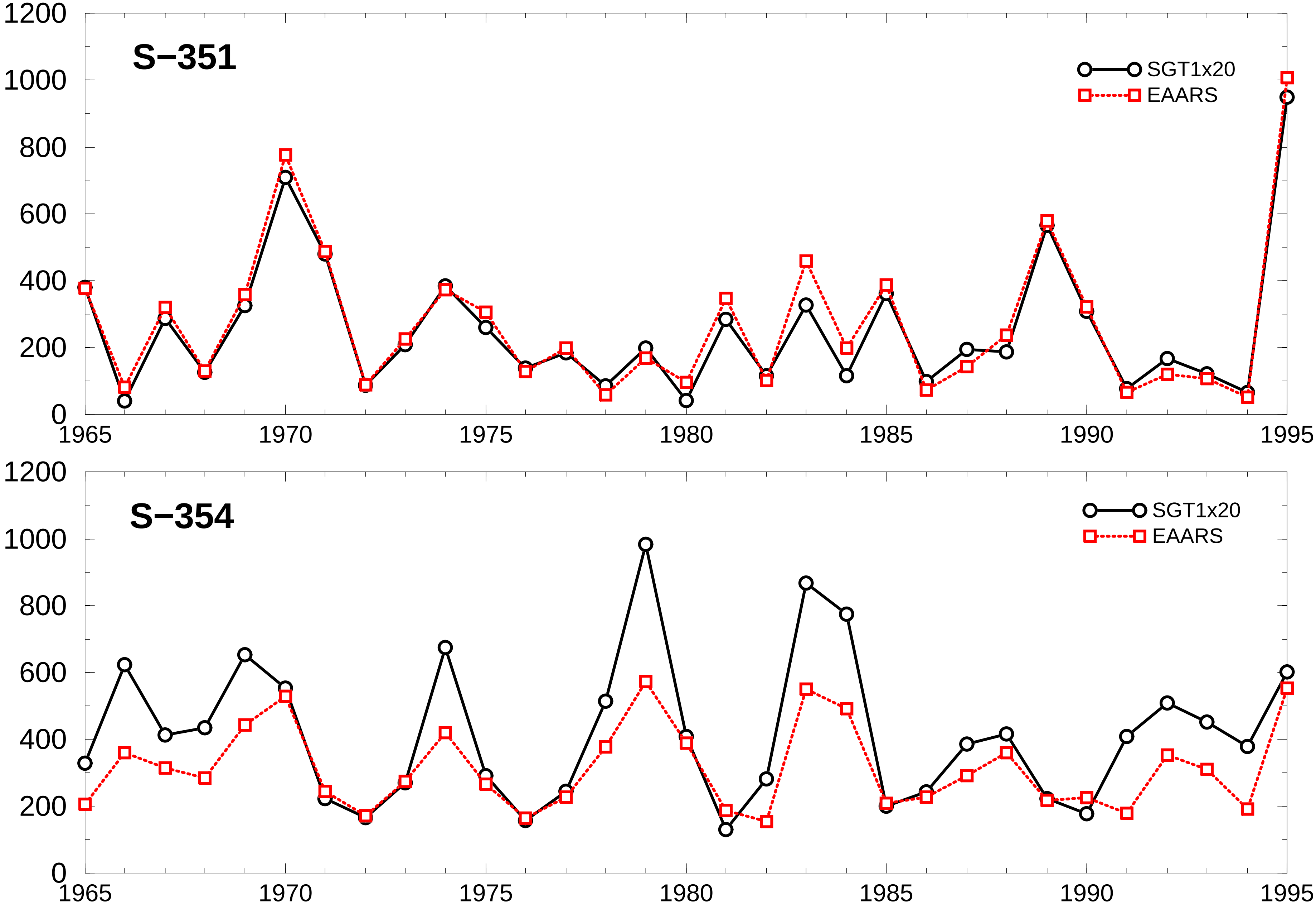
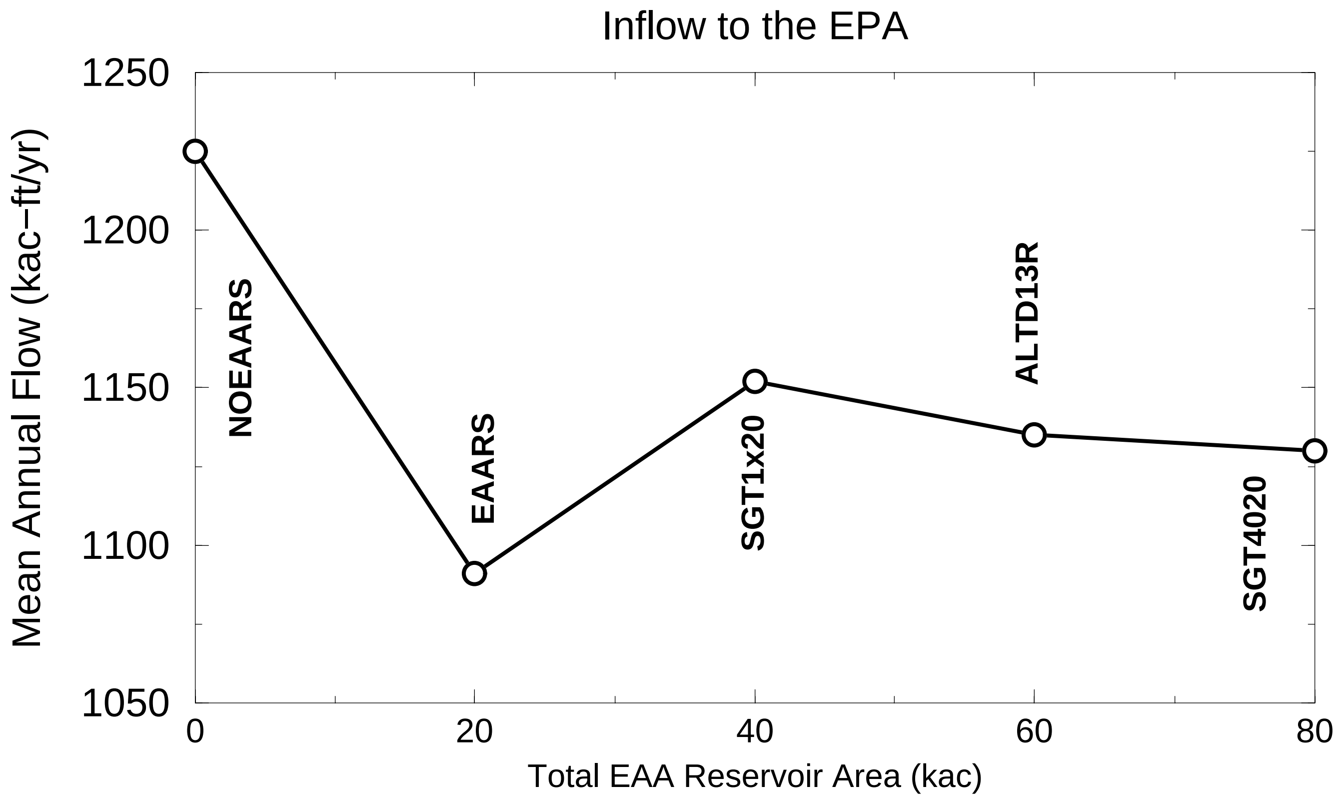


Figure 6. EAA Reservoirs Sensitivity Analysis



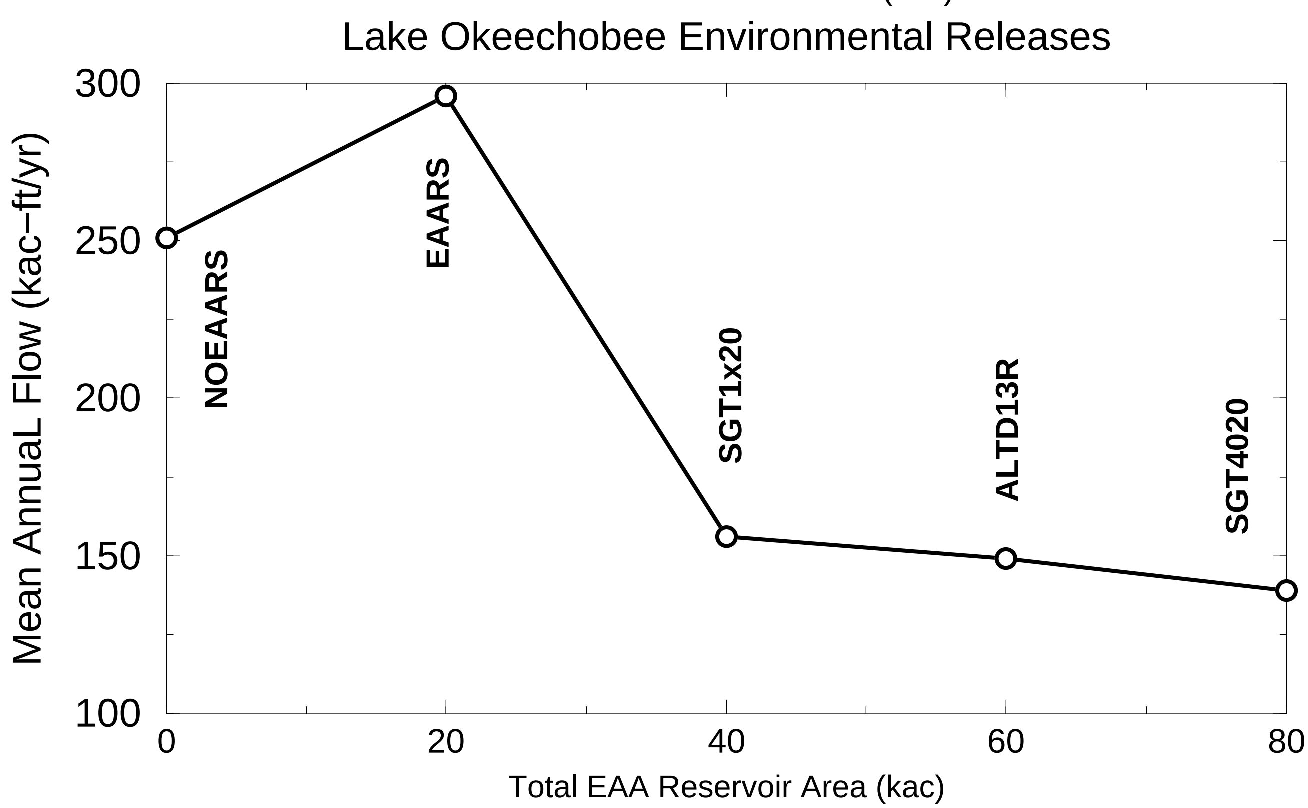


Figure 7. Stage Hydrograph at Central Lake Belt Reservoir

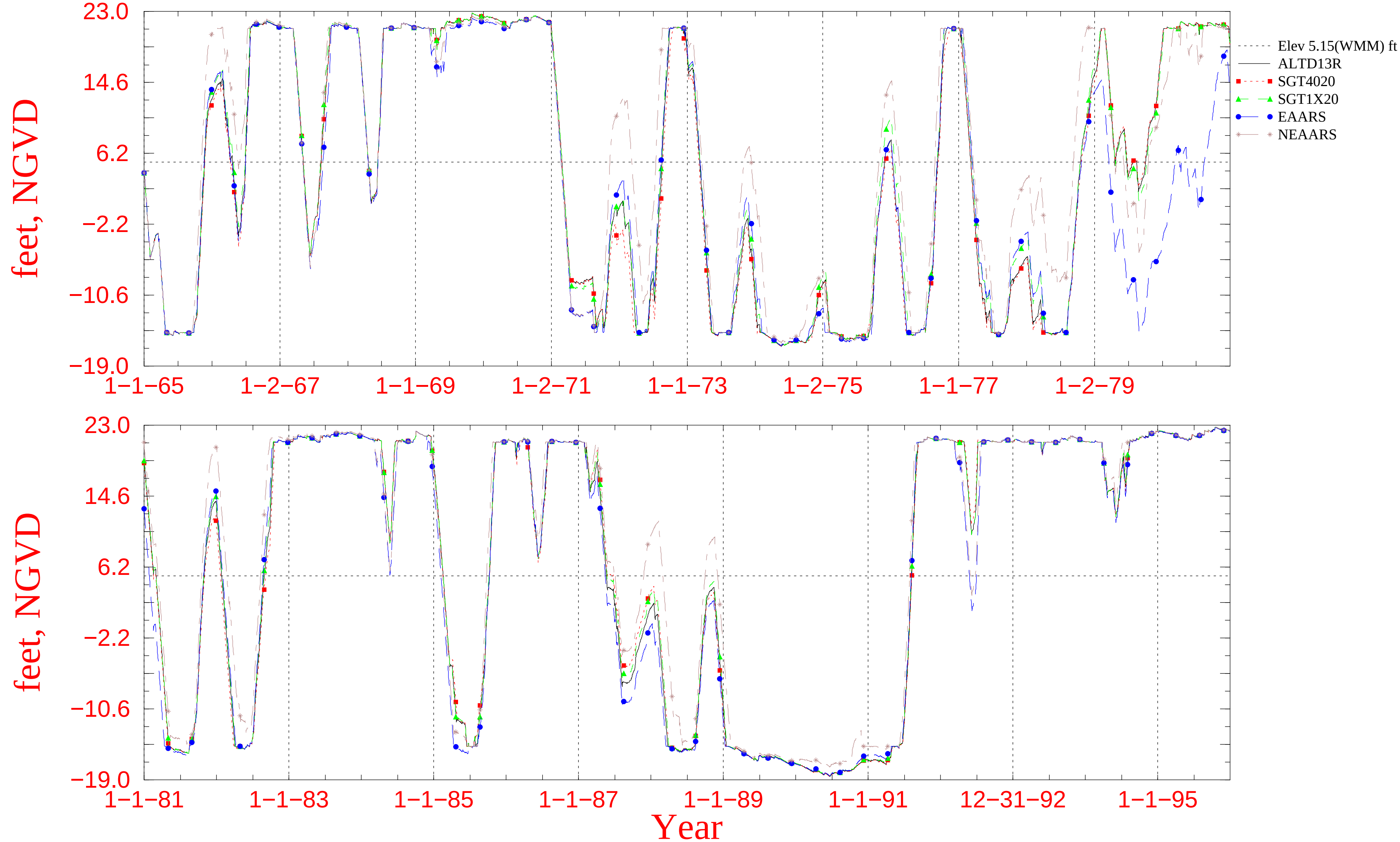


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Figure 8. Number of Undesireable Lake Okeechobee Stage Events

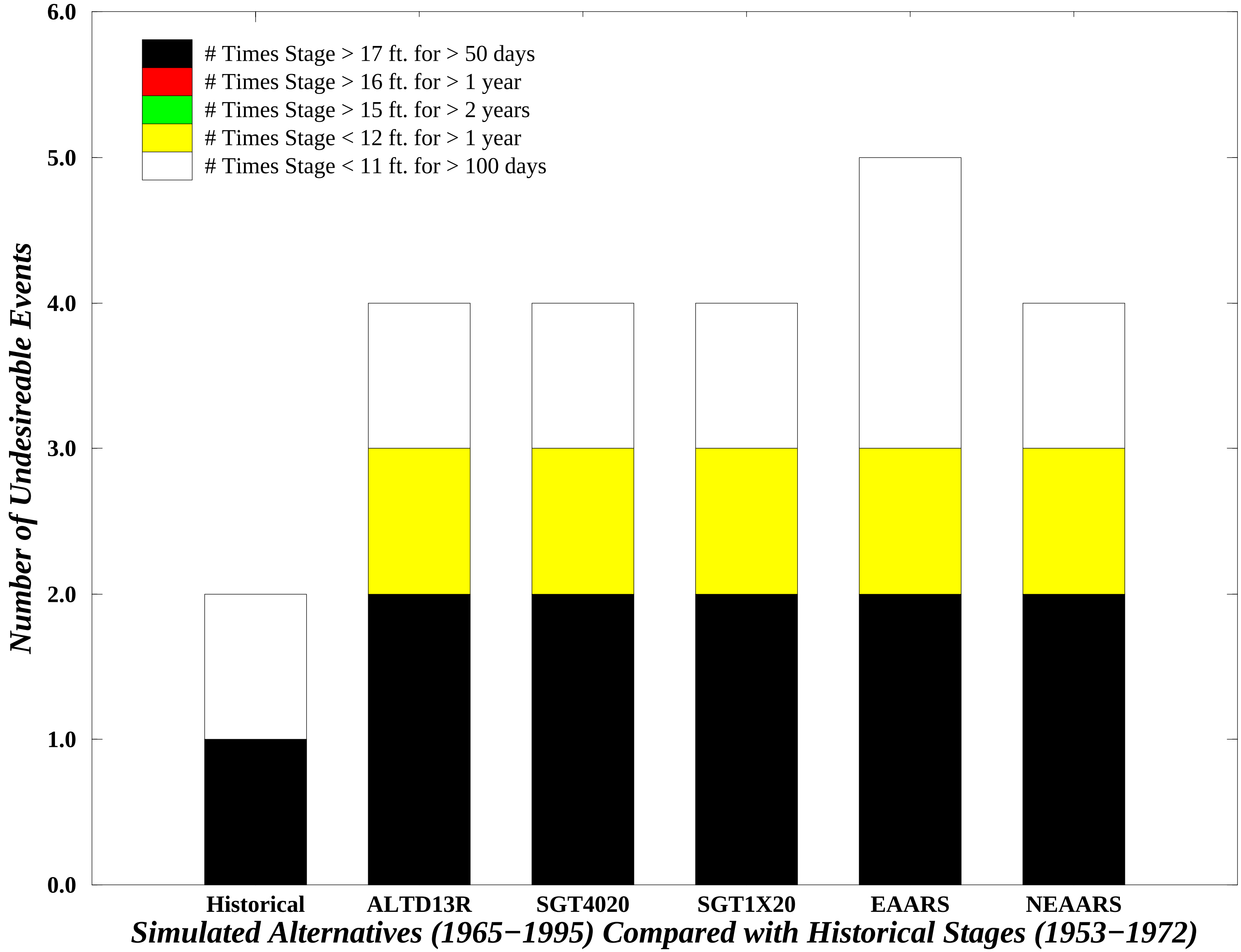

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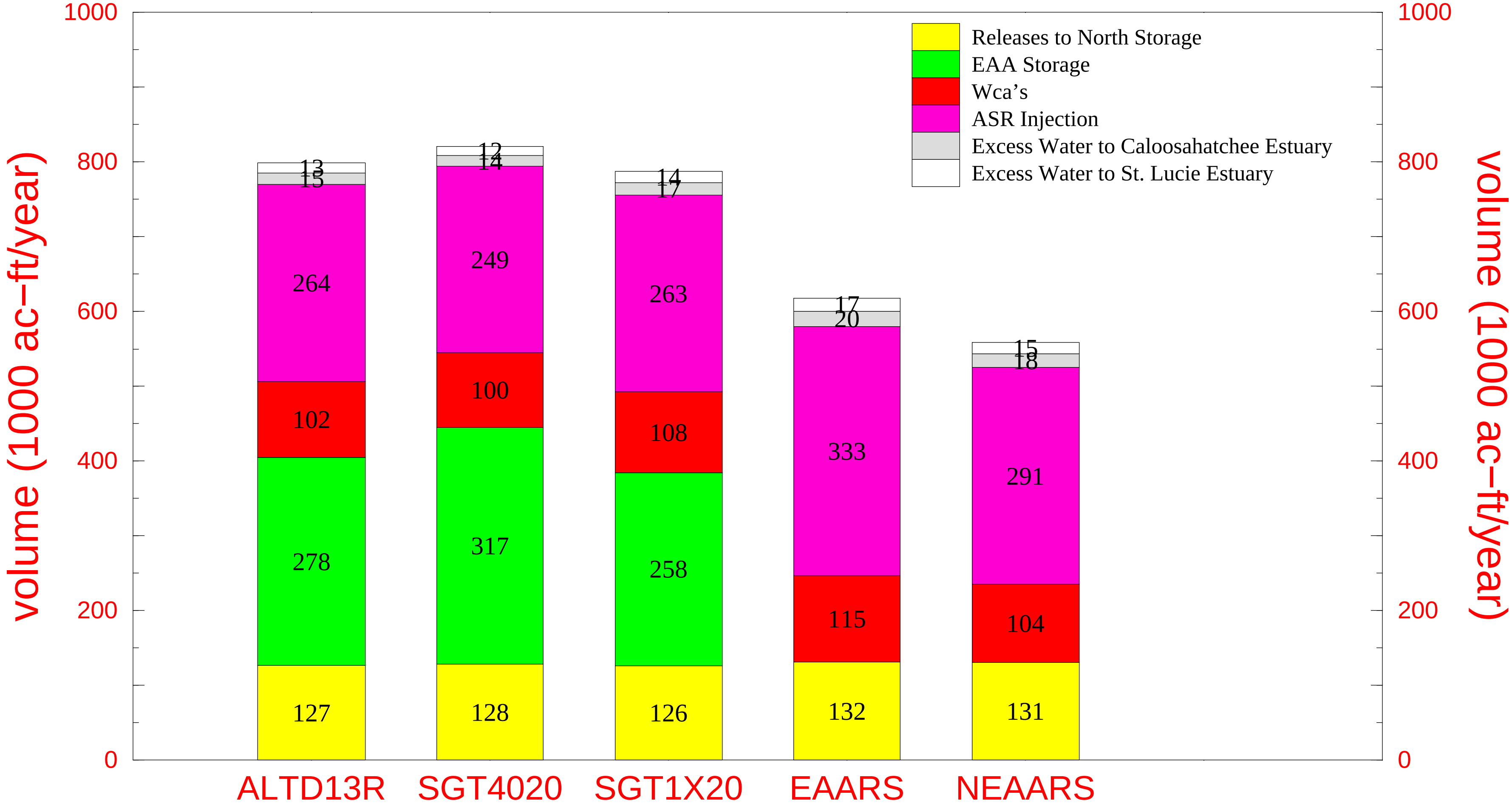
Figure 9. Mean Annual Flood Control Releases from Lake Okeechobee for the 31 yr (1965 − 1995) Simulation



Note: Although regulatory (flood control) discharges are summarized here in mean annual values, they do not occur every year. Typically they occur in 2−4 consecutive years and may not occur for up to 7 consecutive years.

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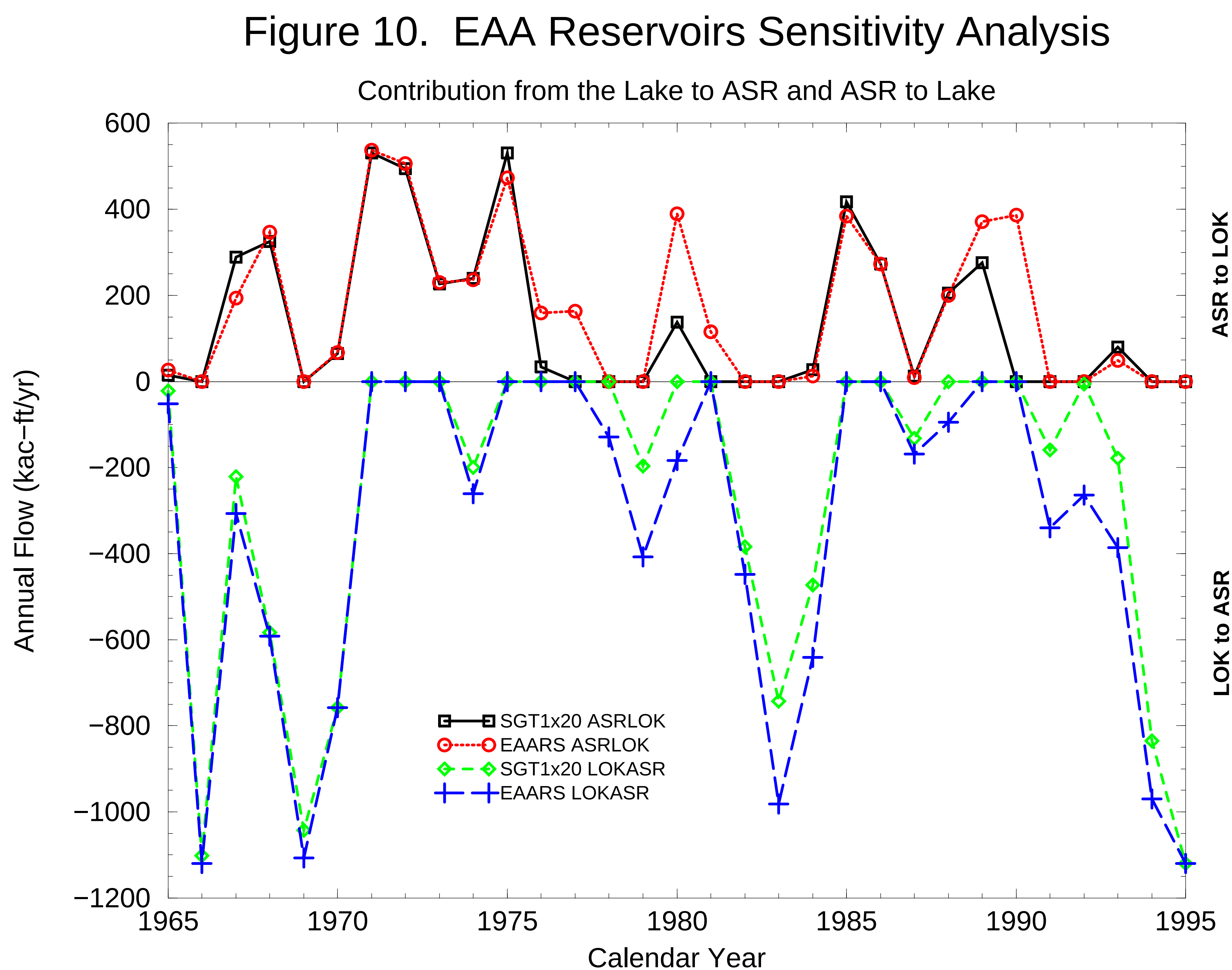
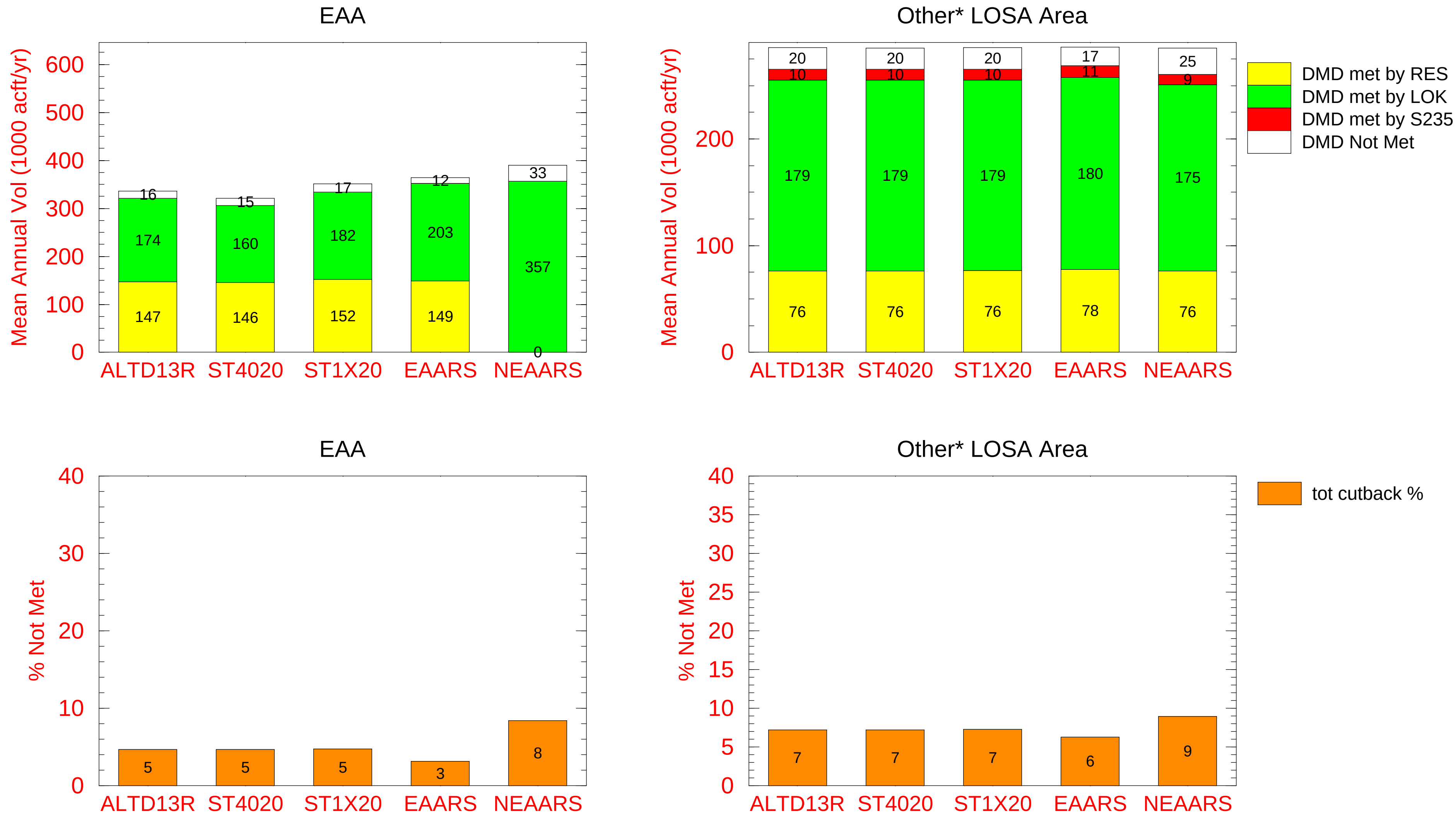


Figure 10. EAA Reservoirs Sensitivity Analysis
Contribution from the Lake to ASR and ASR to Lake
Annual Flow (kac−ft/yr)
600
400
200
0
−200
−400
−600
−800
−1000
−1200
1965
1970
1975
1980
1985
1990
1995
Calendar Year
ASR to LOK
LOK to ASR
SGT1x20 ASRLOK
EAARS ASRLOK
SGT1x20 LOKASR
EAARS LOKASR

Fugure 11. Mean Annual EAA/LOSA Supplemental Irrigation: Demands and Demands Not Met

for the 1965 − 1995 Simulation Period



*Other Lake Service SubAreas (S236, S4, L8, C43, C44, and Seminole Indians (Brighton & Big Cypress)).

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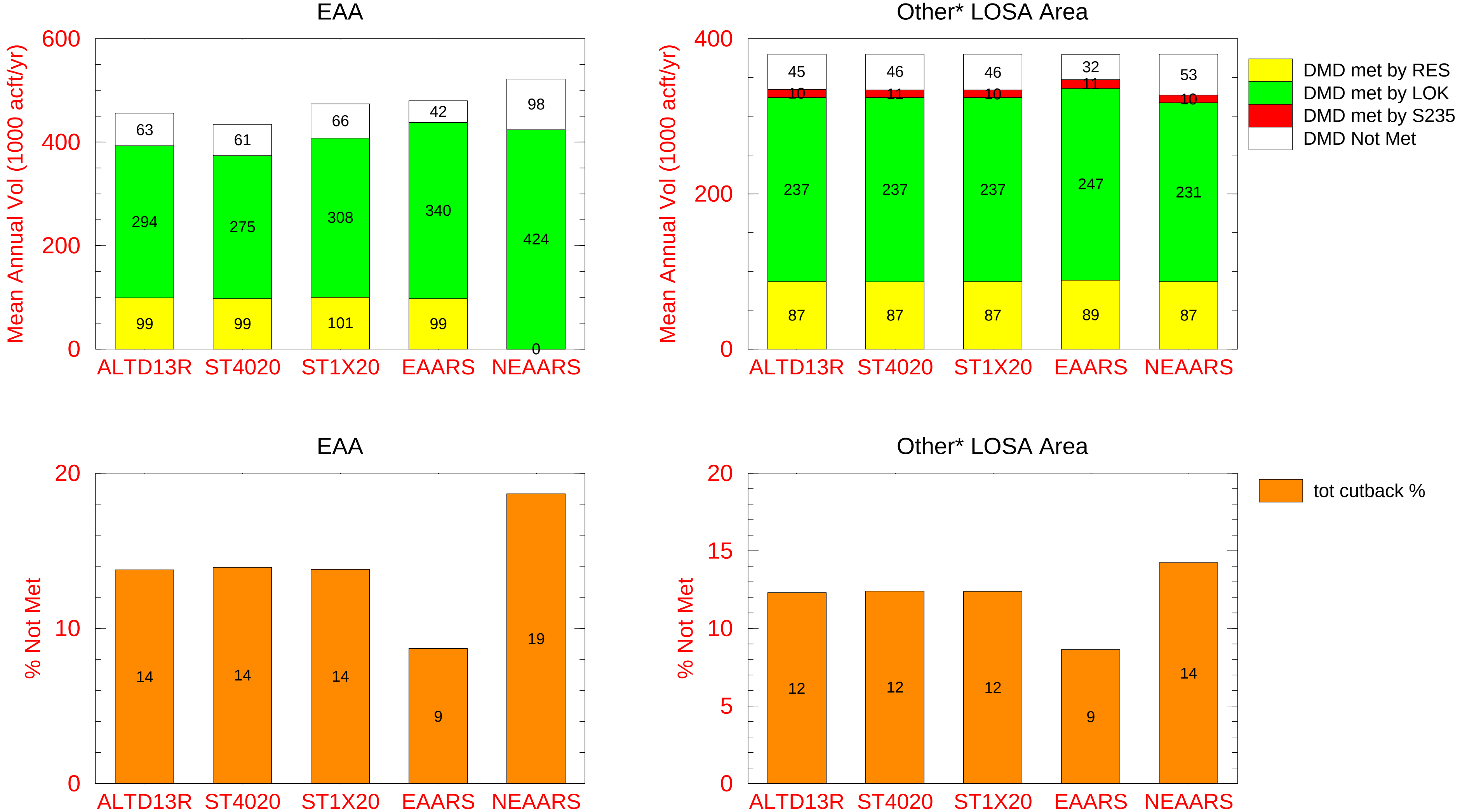
Figure 12. Mean Annual EAA/LOSA Supplemental Irrigation:
Demands and Demands Not Met for the Drought Years:
1971, 1975, 1981, 1985, 1989 within the 1965 − 1995 Simulation Period



*Other Lake Service SubAreas (S236, S4, L8, C43, C44, and Seminole Indians (Brighton & Big Cypress)).

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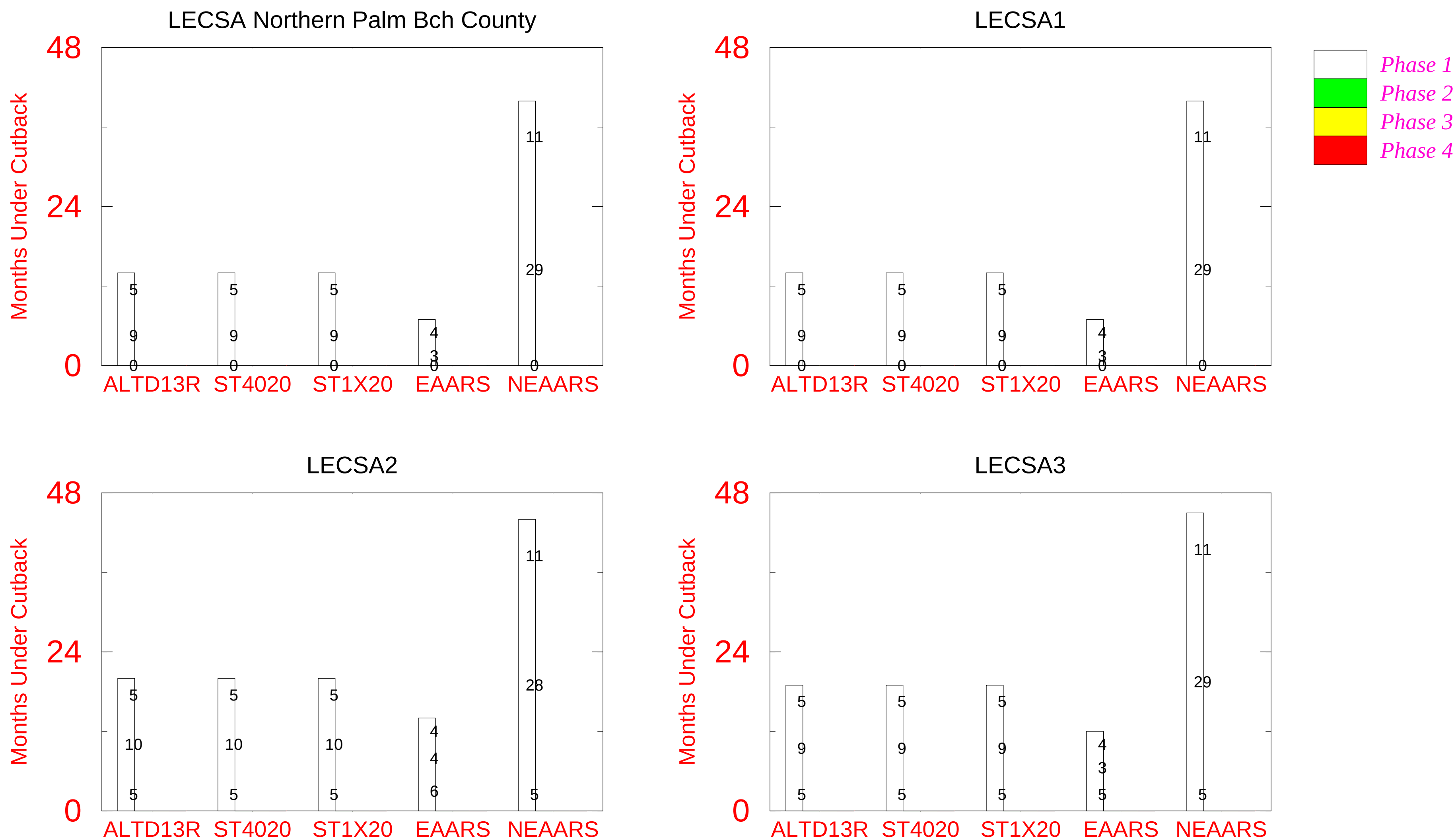
Figure 13. Number of Months of Simulated Water Supply Cutbacks

for the 1965 − 1995 Simulation Period



Note: Phase 1 water restrictions could be induced by a) Lake stage in Supply Side Management Zone (indicated by upper data label), b) Local Trigger well stages (lower data label), and c) Dry season criteria (indicated by middle data label).

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Figure 14. Number of times Salinity Envelope Criteria were NOT met for the St. Lucie Estuary

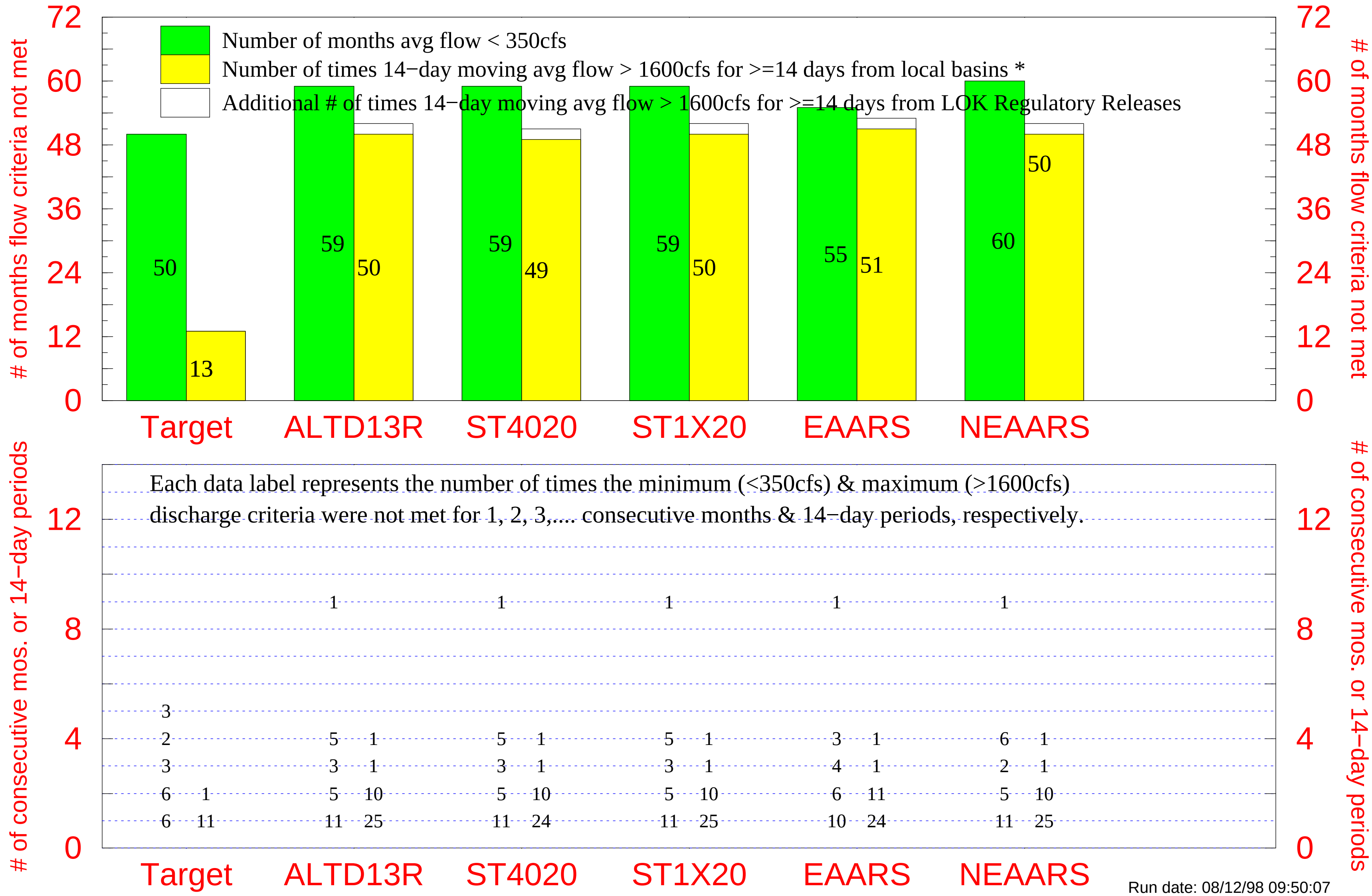

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Figure 15. Number of times Salinity Envelope Criteria were NOT met for the Caloosahatchee Estuary (mean monthly flows 1965 − 1995)

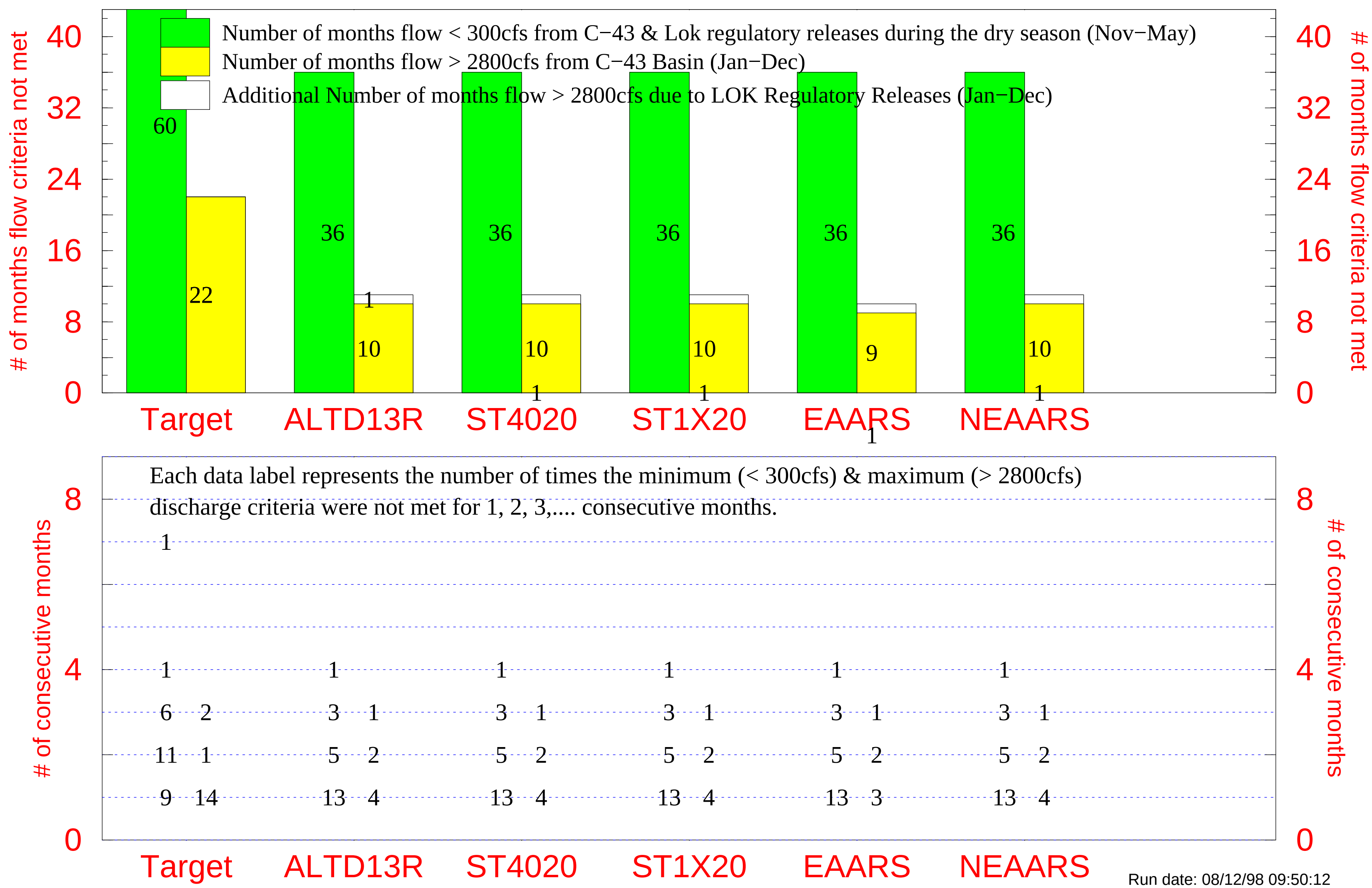

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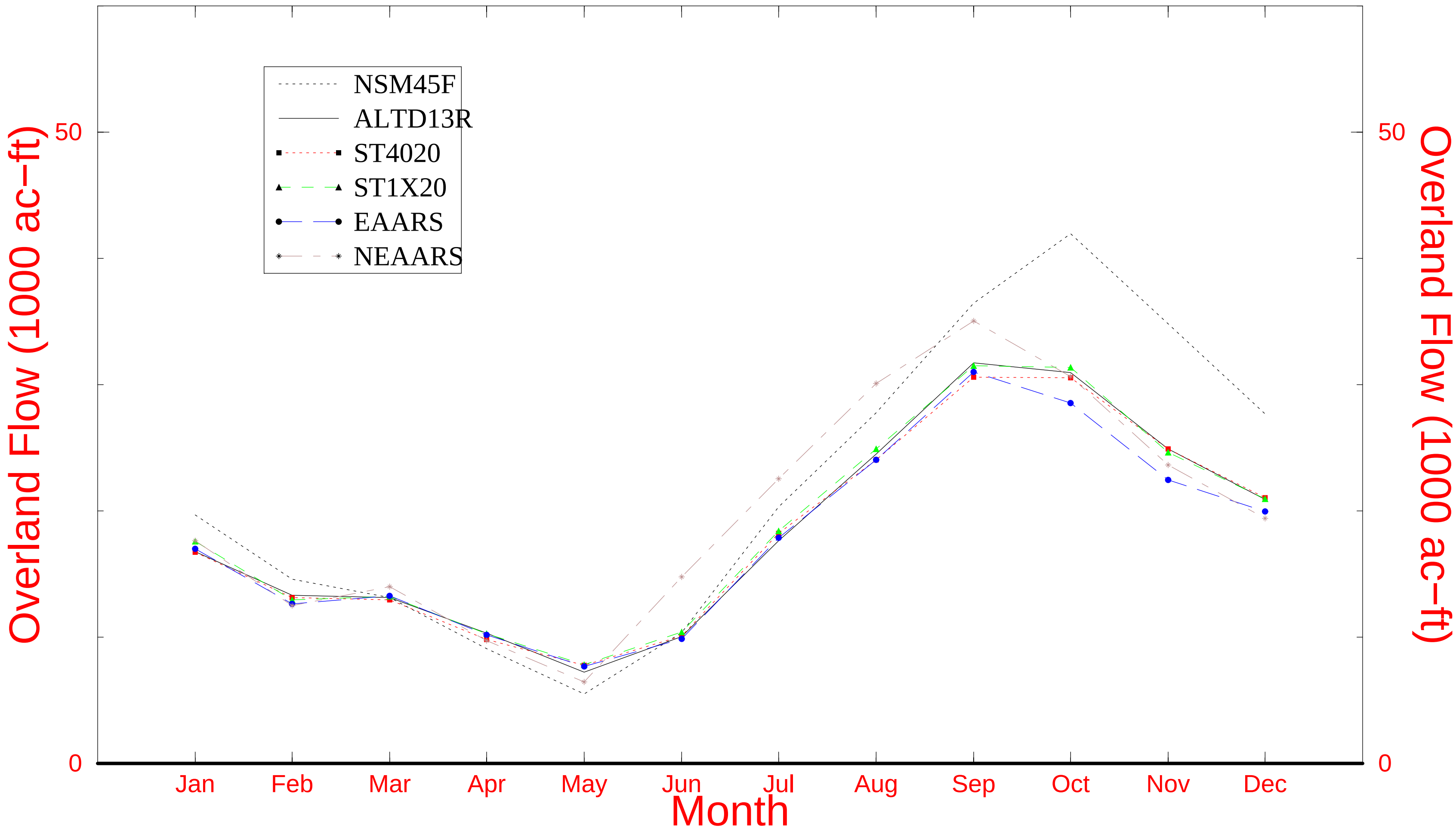
Figure 16. Average Monthly Overland Flows in northwestern WCA−3A
T5 (R41, C16−18) for the 31 yr. simulation



Note: NSM flows are NOT targets and are shown for comparative purposes only.

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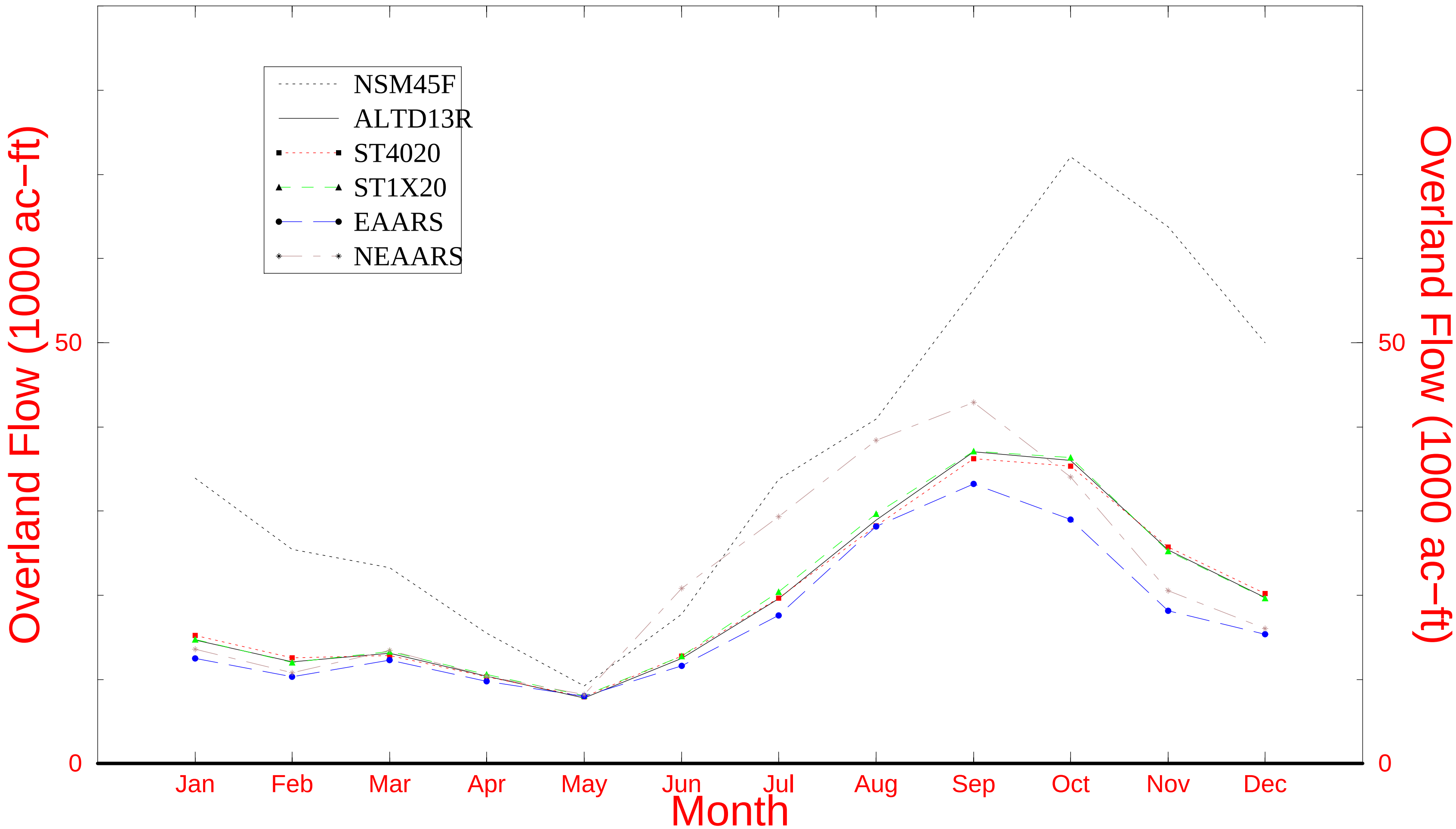
Figure 17. Average Monthly Overland Flows in northeastern WCA−3A
T6 (R41, C19−25) for the 31 yr. simulation



Note: NSM flows are NOT targets and are shown for comparative purposes only.

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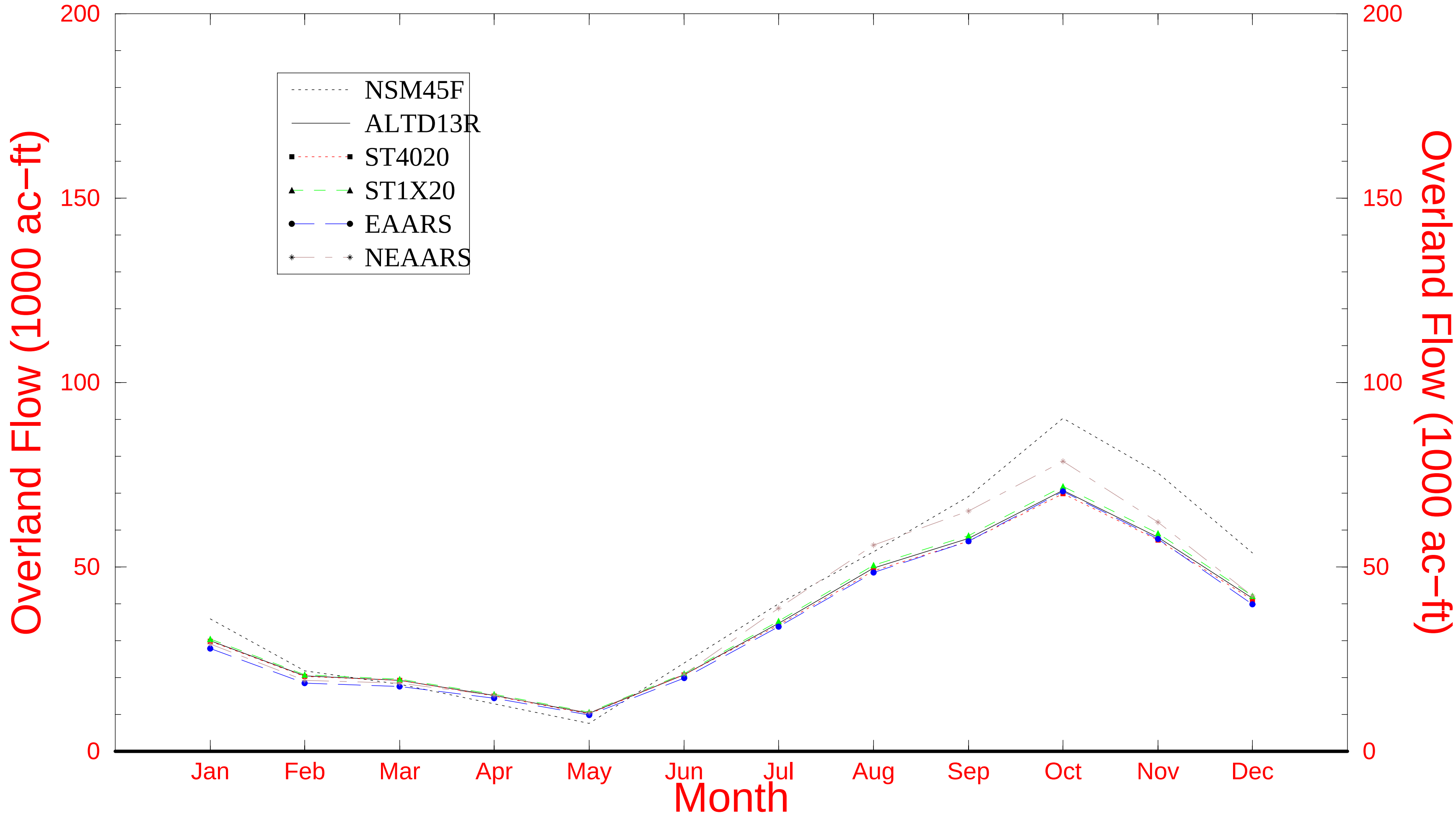
Figure 18. Average Monthly Overland Flows South of Tamiami Trail West of L−67 ext. to ENP T17 (R22, C17−21) for the 31 yr. simulation



Note: NSM flows are NOT targets and are shown for comparative purposes only.

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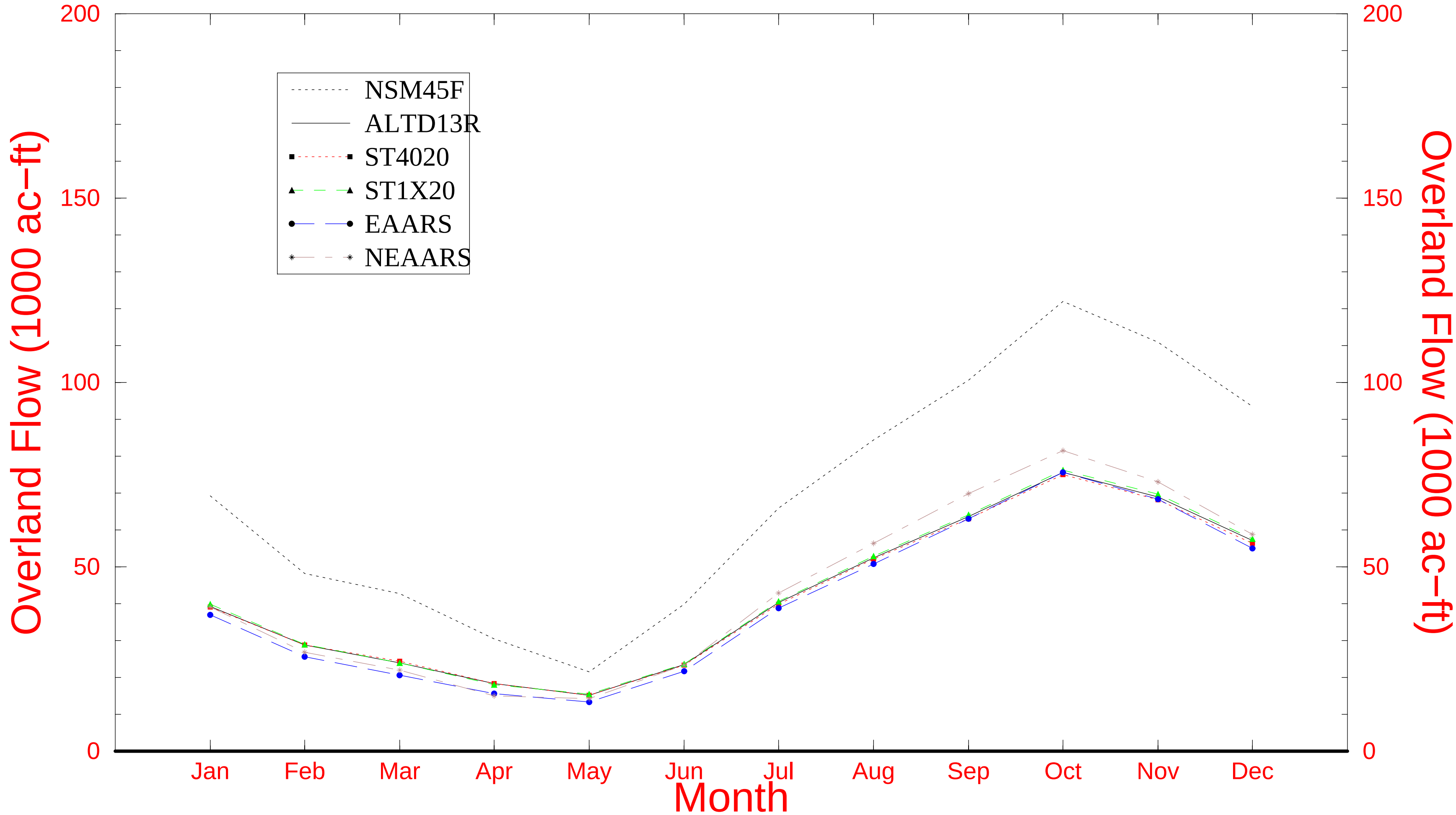
SFWMM V3.5

Figure 19. Average Monthly Overland Flows South of Tamiami Trail East of L−67 ext. to ENP T18 (R22, C22−26) for the 31 yr. simulation



Note: NSM flows are NOT targets and are shown for comparative purposes only.

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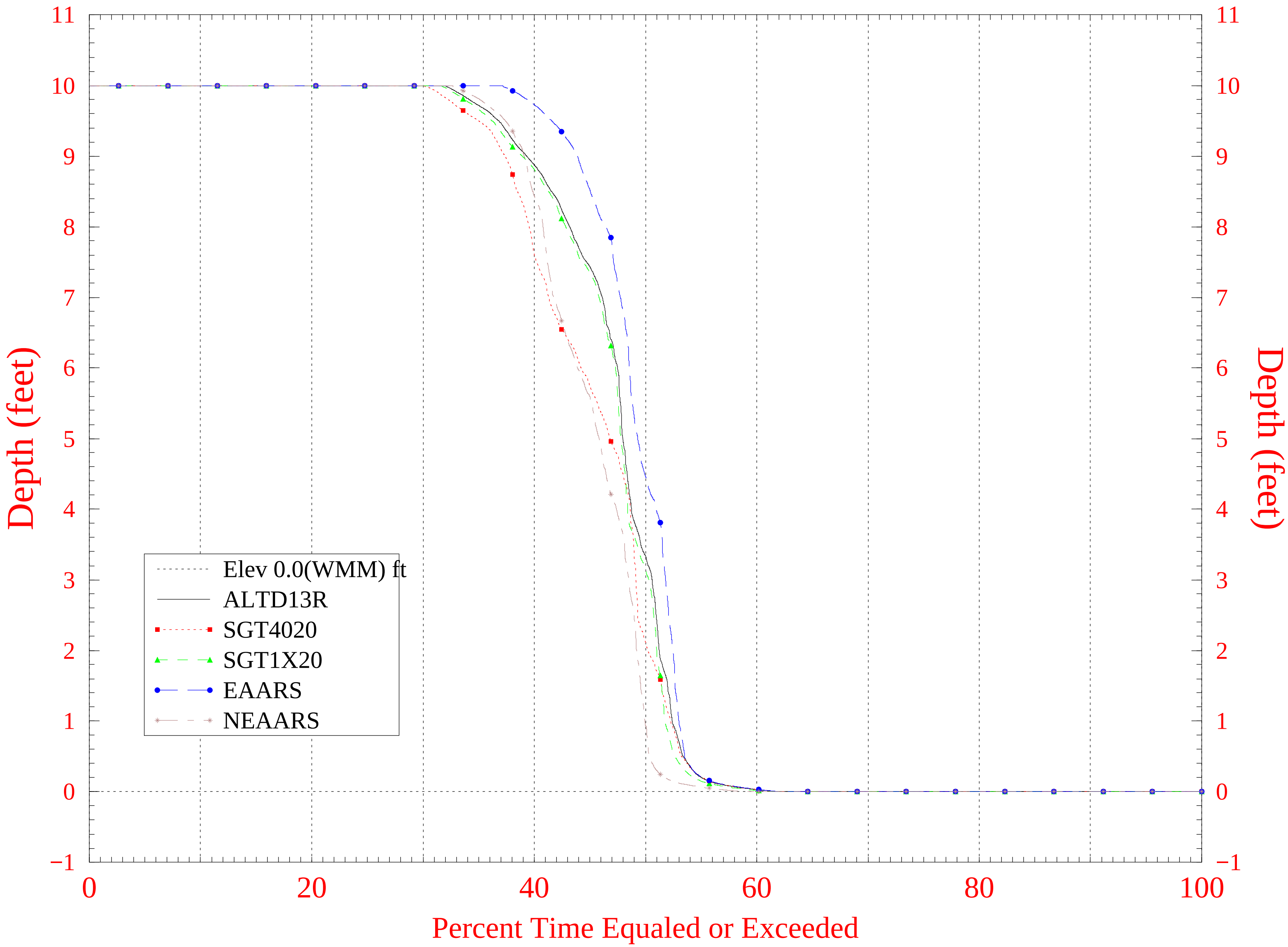
Figure 20. Stage Duration Curves at North Storage Reservoir



Run date: 08/12/98 12:47:28
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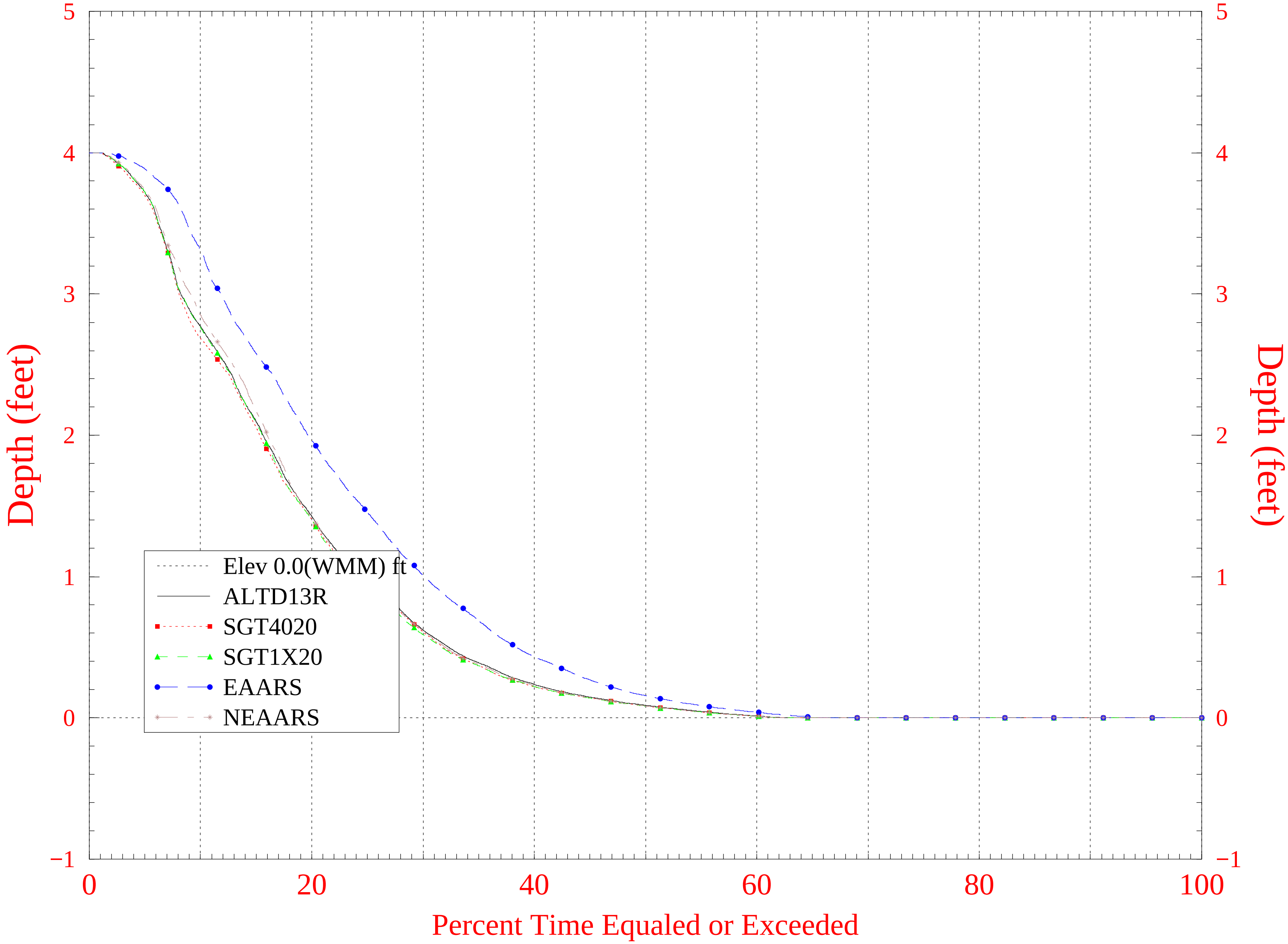
Figure 21. Stage Duration Curves at C44 Reservoir



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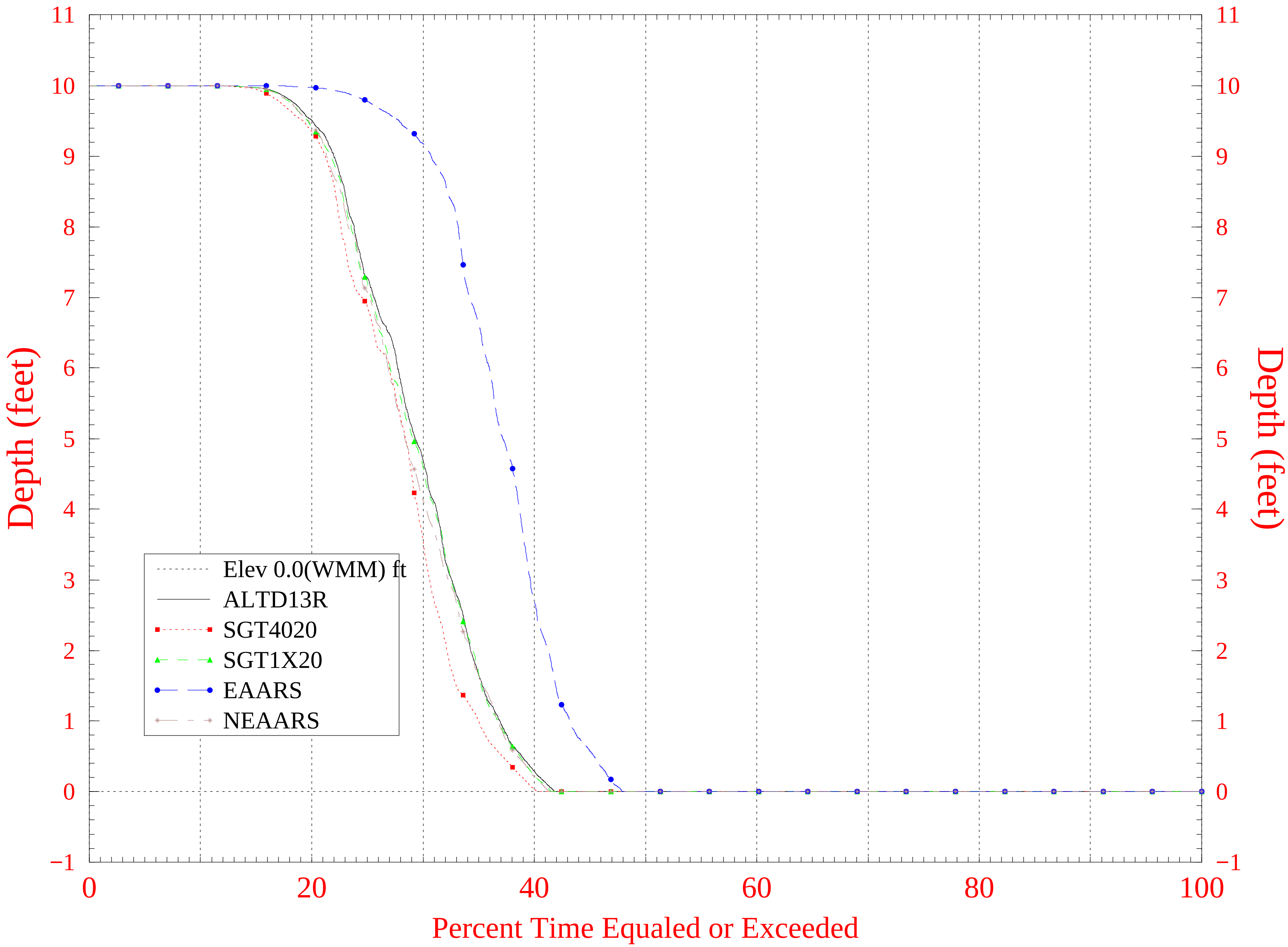
For Planning Purposes Only
SFWMM V3.5

Figure 22. Stage Duration Curves at Taylor Creek−Nubbin Slough Reservoir



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For Planning Purposes Only
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Figure 23. Stage Duration Curves at C43 Reservoir

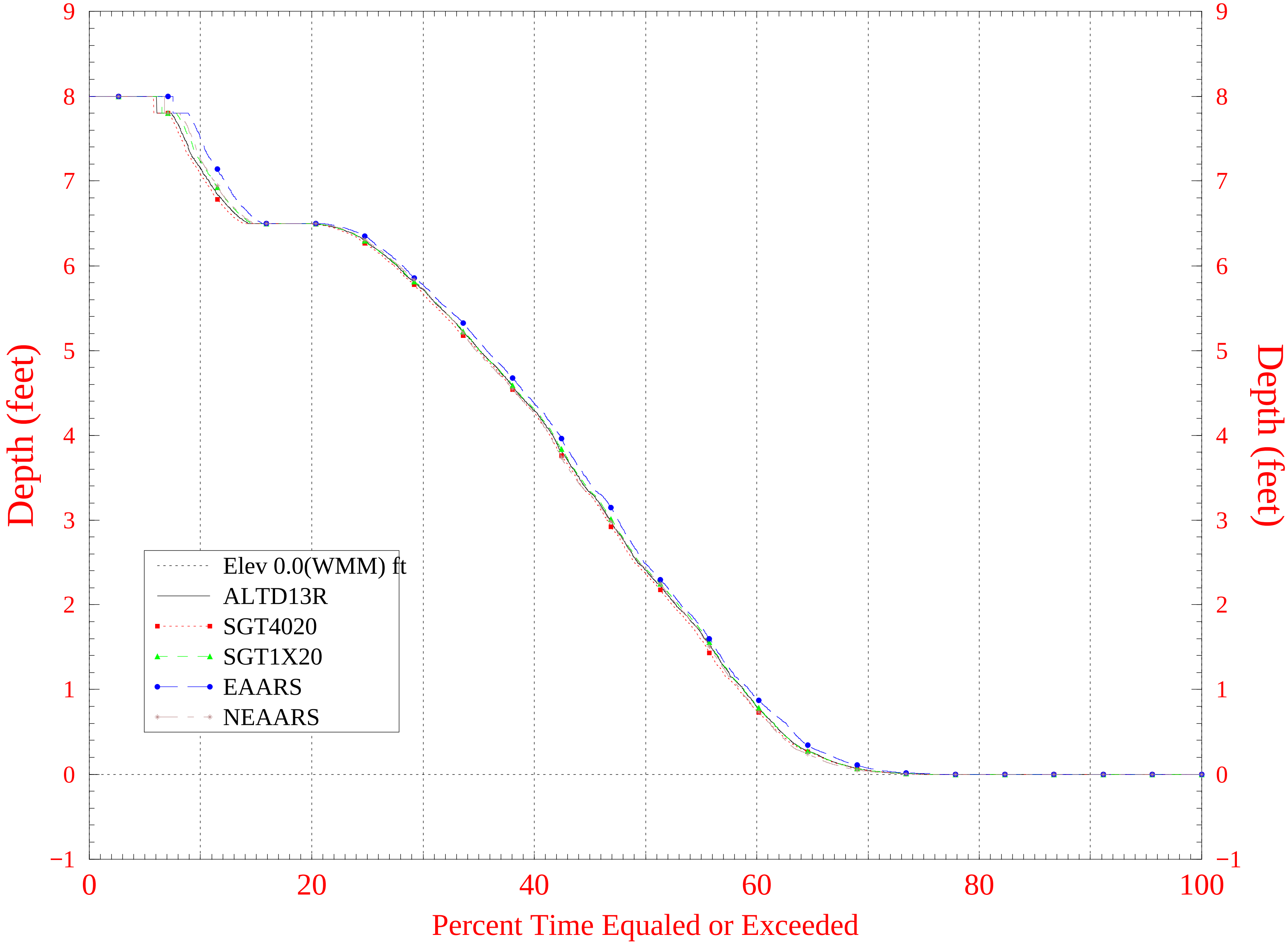

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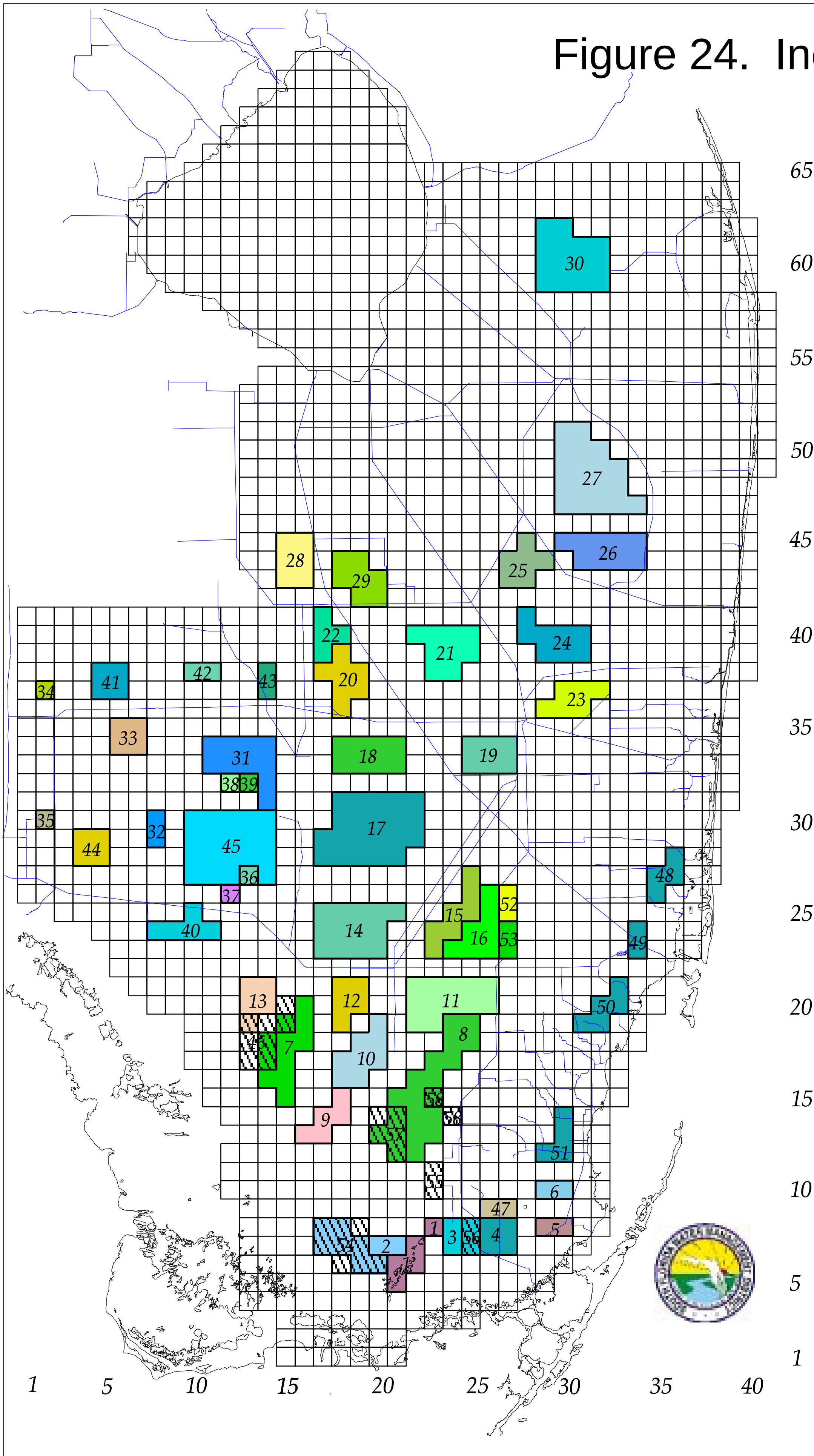
Figure 24. Indicator Regions

Updated April 13, 1998



1=Taylor Slough
2=West Perrine Marl Marsh
3=Mid-Perrine Marl Marsh
4=C-111 Perrine Marl Marsh
5=Model Lands South
6=Model Lands North
7=Ochopee Marl Marsh
8=Rockland Marl Marsh
9=SW Shark River Slough
10=Mid-Shark River Slough
11=NE Shark River Slough
12=New Shark River Slough
13=West Slough
14=South WCA-3A
15=West WCA-3B
16=East WCA-3B
17=South Central WCA-3A
18=North Central WCA-3A
19=East WCA-3A
20=NW WCA-3A
21=NE WCA-3A
22=NW Corner WCA-3A
23=WCA-2B
24=South WCA-2A
25=North WCA-2A
26=South WCA-1 (LNWR)
27=North WCA-1 (LNWR)
28=Rotenberger WMA
29=Holey Land WMA
30=Corbett WMA
31=Mullet Slough
32=Upland Pine
33=Upper Mullet Slough
34=Cypress Marsh
35=Wet Prairie
36=Wetter Prairie NE
37=Wetter Prairie SW
38=Drier Cypress NW
39=Drier Cypress NE
40=Cypress
41=NW Big Cypress
42=NE Big Cypress
43=NE Corner Big Cypress
44=SW Big Cypress
45=Racoon Point
47=North C-111
48=N. Biscayne Bay Groundwater 1
49=N. Biscayne Bay Groundwater 2
50=Central Biscayne Bay Groundwater
51=S. Biscayne Bay Groundwater
52=Pennsuco Wetlands North
53=Pennsuco Wetlands South
46=Cape Sable Sparrow A
54=Cape Sable Sparrow B
55=Cape Sable Sparrow C
56=Cape Sable Sparrow D
57=Cape Sable Sparrow E
58=Cape Sable Sparrow F

Figure 25. FLOW TRANSECTS